

Sol Data

Our Objective

To Simplify

Real-Time Monitoring

Sol Data

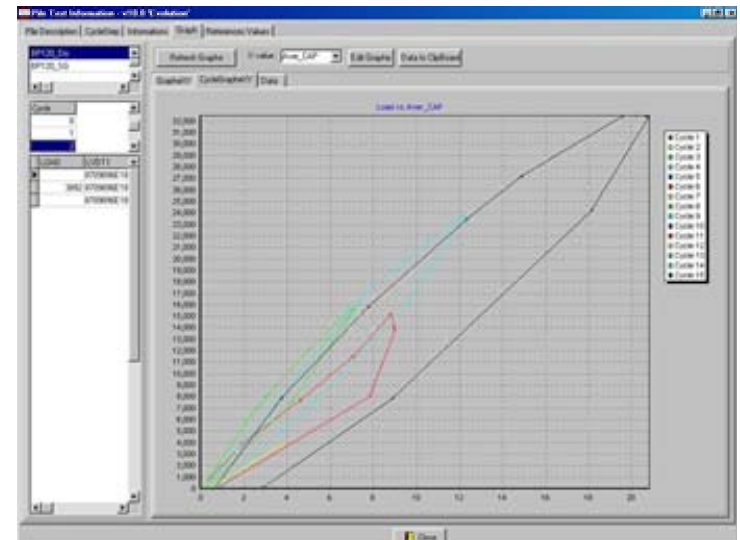
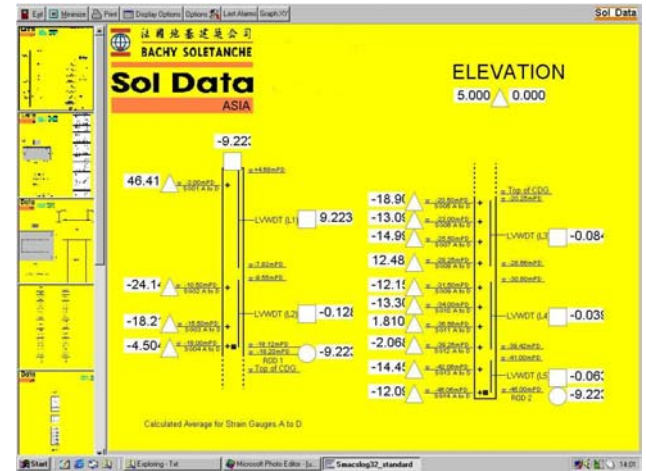
PART 1

Real-Time Monitoring of Loading/Stressing



Total Monitoring Service

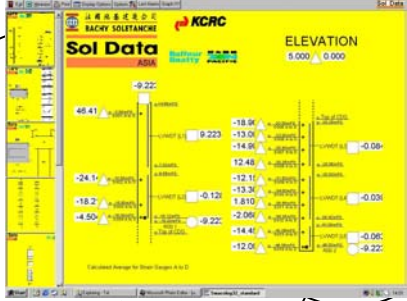
2



- **Comprehensive pile or anchor monitoring software.**
- **Configurable for all geotechnical and measuring instruments.**
- **Real Time monitoring.**
- **Database available for analysis during test.**
- **Data configurable for every data set.**
- **Data export real time for extra analysis.**
- **Multi view software.**
- **Remote Monitoring.**

**Custom installation of instruments to suit the clients needs.
SOL DATA can provide the full range of geotechnical instruments
Prepare, Install, Connect and Measure**

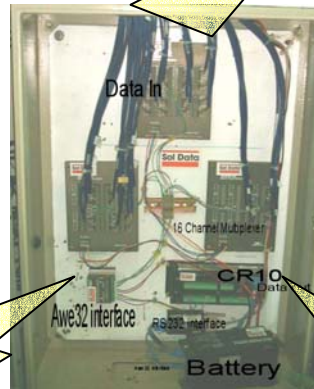




Real Time



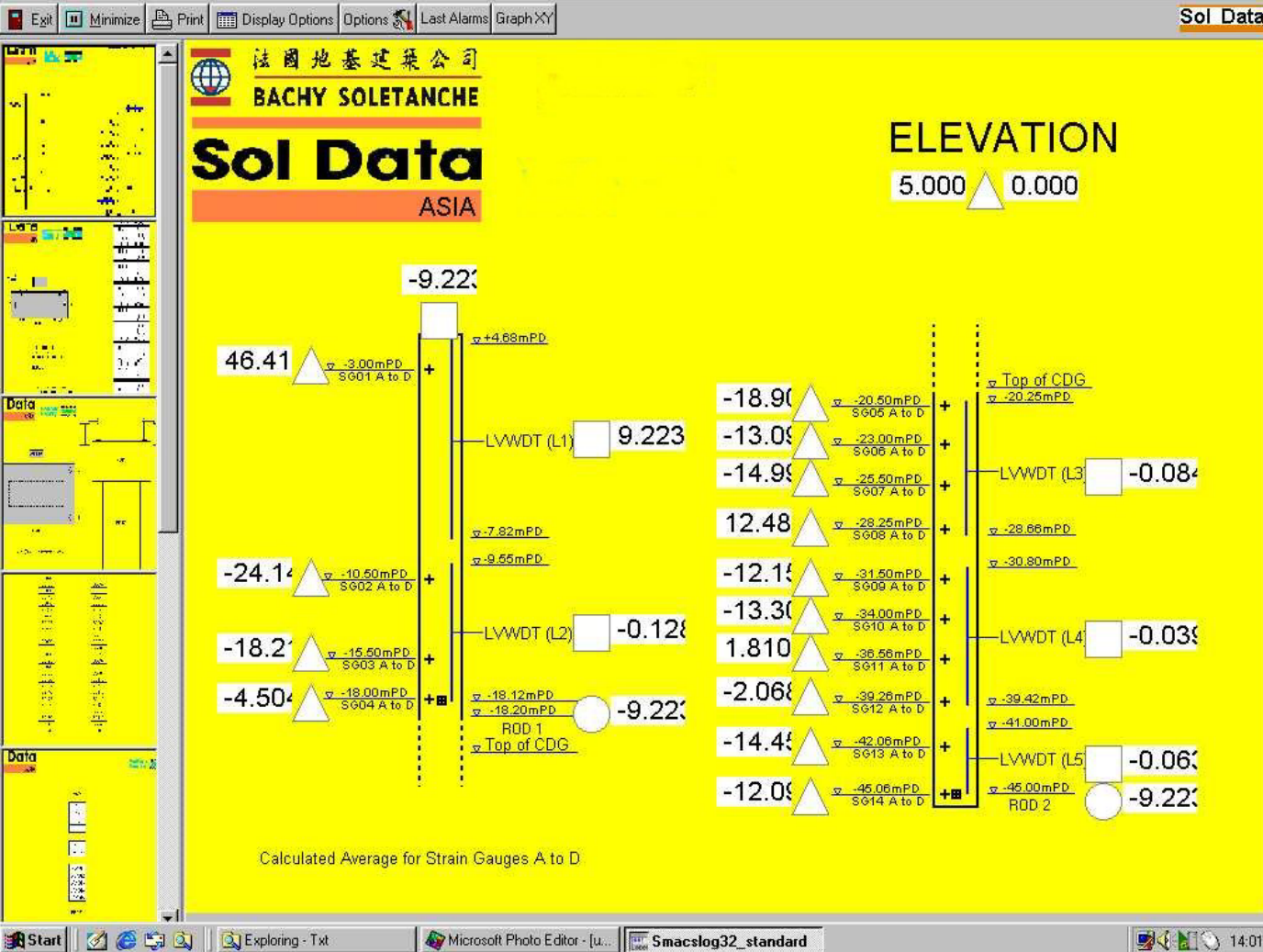
Instrument Logging



Load cell logging and control

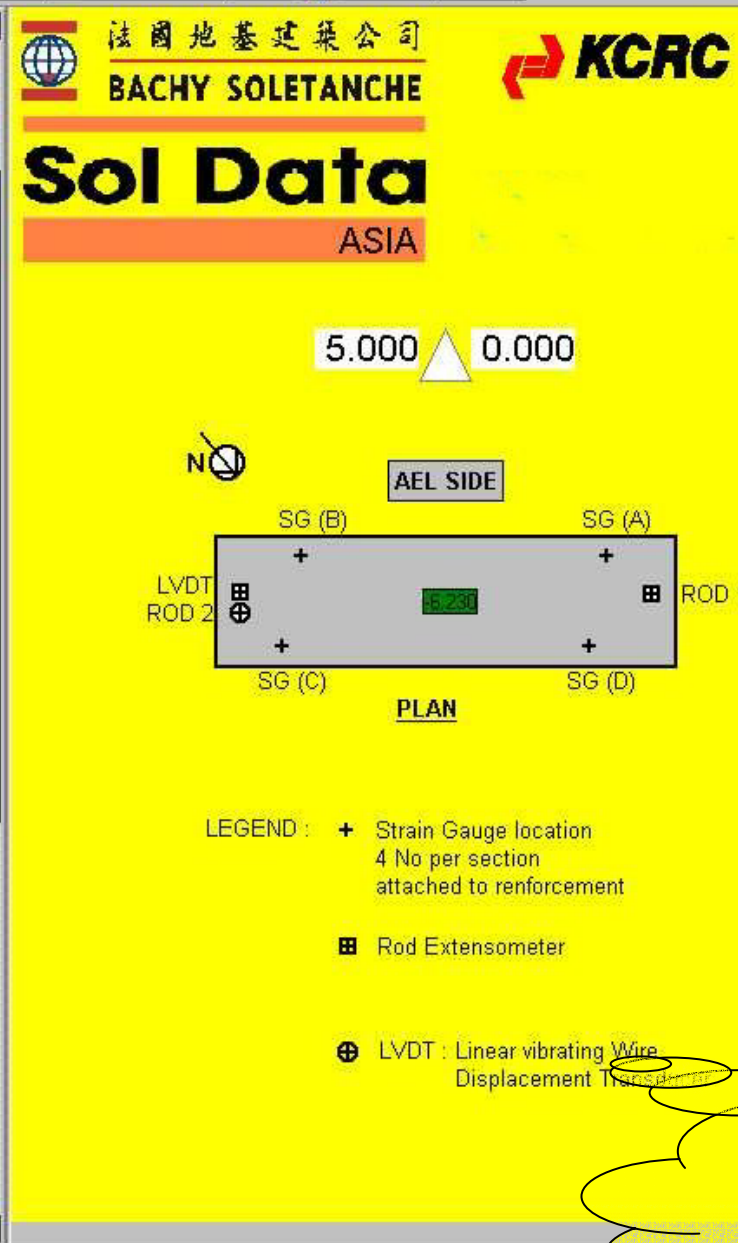
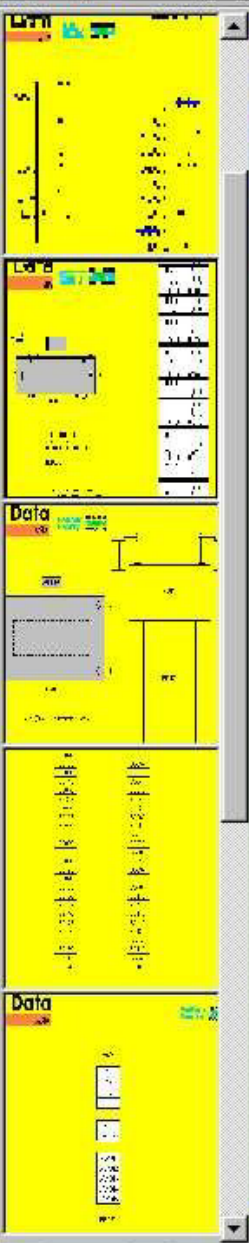
Settlement logging





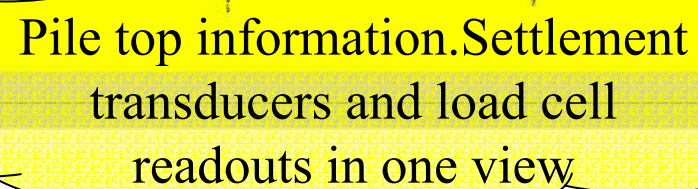
A fully instrumented Pile or Anchor can be seen on the screen and real-time.

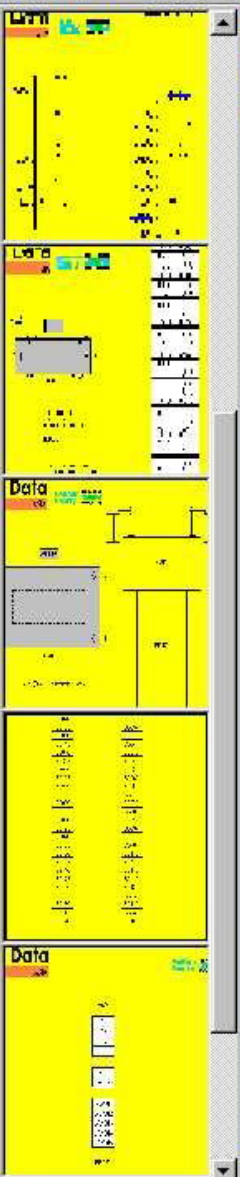
Allowing Engineers to assess the critical information fast.



54.61	SG01B	SG01A	41.09
46.39	SG01C	SG01D	43.55
-19.9	SG02B	SG02A	-39.79
-7.68	SG02C	SG02D	-29.16
-1.64	SG03B	SG03A	-17.95
-26.8	SG03C	SG03D	-26.37
-15.7	SG04B	SG04A	25.43
-16.7	SG04C	SG04D	-10.9
-24.4	SG05B	SG05A	-18.18
-24.3	SG05C	SG05D	-8.728
-21.1	SG06B	SG06A	-4.525
-23.7	SG06C	SG06D	-2.96
-17.2	SG07B	SG07A	-0.835
-23.7	SG07C	SG07D	-18.1
-8.71	SG08B	SG08A	-13.35
27.14	SG08C	SG08D	44.85
-10.1	SG09B	SG09A	-12.46
-9.86	SG09C	SG09D	-16.14
-14.0	SG10B	SG10A	-12.33
-7.09	SG10C	SG10D	-19.74
-10.2	SG11B	SG11A	-13.90
35.31	SG11C	SG11D	-3.937
26.26	SG12B	SG12A	-4.603
-13.8	SG12C	SG12D	-16.05
-13.7	SG13B	SG13A	-9.335
-19.9	SG13C	SG13D	-14.78
-7.09	SG14B	SG14A	-14.16
-14.1	SG14C	SG14D	-12.67

Multi section views, giving precise location of instruments and their values.





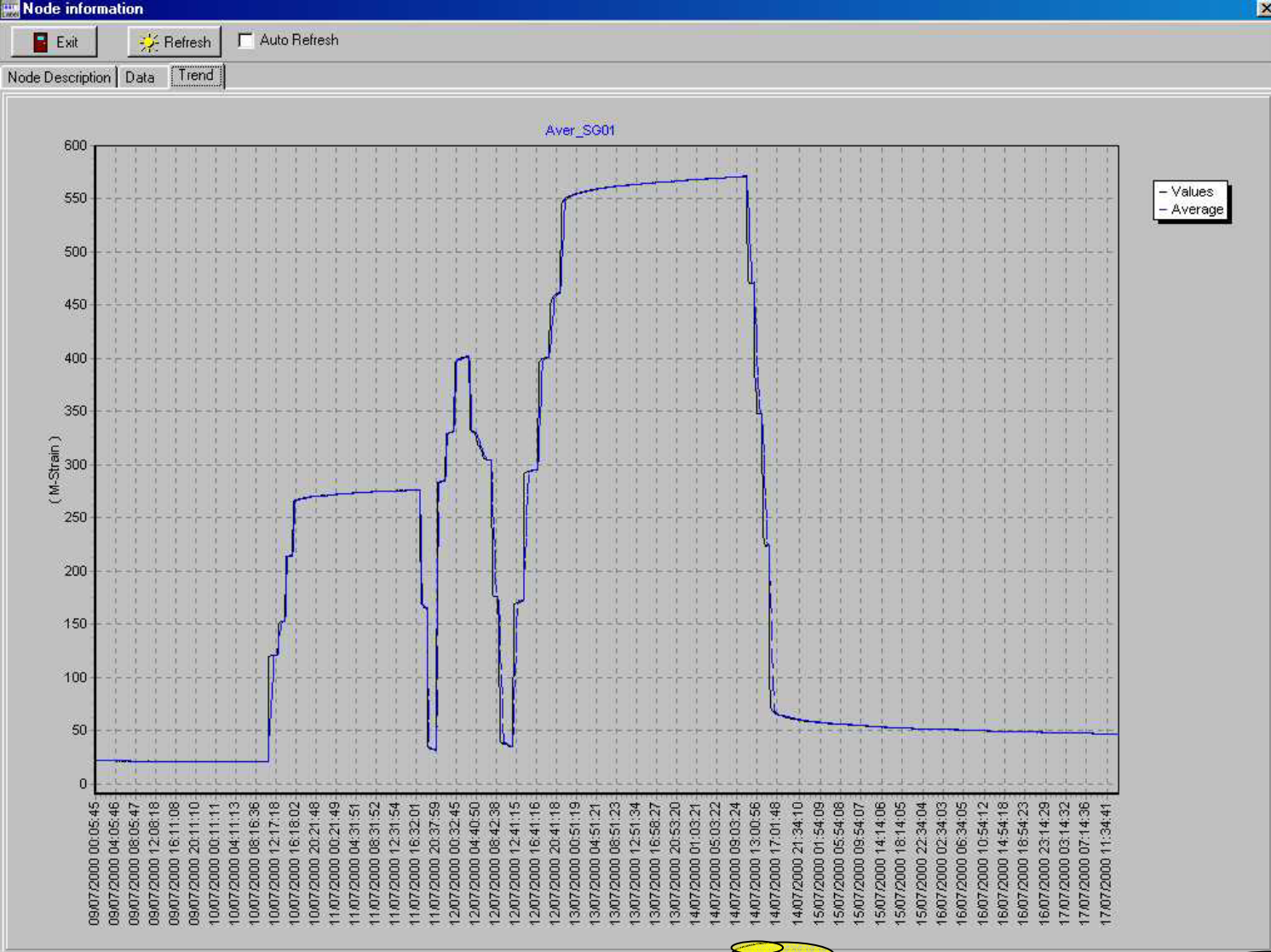
法国地基建兵公司
BACHY SOLETANCHE
Sol Data
ASIA

 **KCRG**

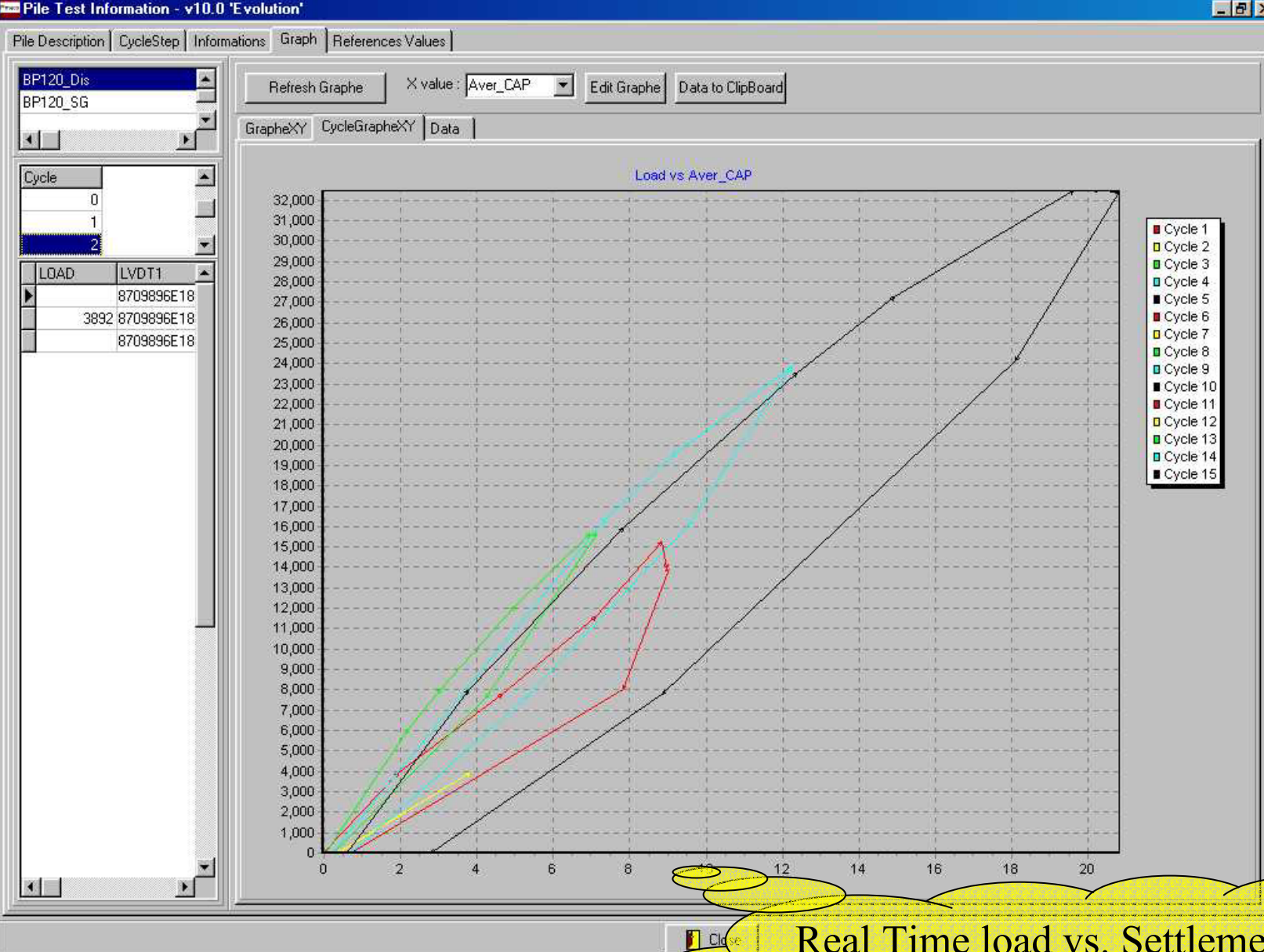
6304.	↑	SG01B	↑	30.446499.	↑	SG01A	↑	33.14
6384.	↑	SG01C	↑	30.4 6430.	↑	SG01D	↑	30.11
6052.	↑	SG02B	↑	26.436285.	↑	SG02A	↑	26.20
6076.	↑	SG02C	↑	26.92 6155.	↑	SG02D	↑	26.36
6436.	↑	SG03B	↑	27.606333.	↑	SG03A	↑	27.23
6152.	↑	SG03C	↑	27.37 6164.	↑	SG03D	↑	27.37
6455.	↑	SG04B	↑	27.216563.	↑	SG04A	↑	27.41
6187.	↑	SG04C	↑	27.5 6094.	↑	SG04D	↑	27.61
6104.	↑	SG05B	↑	27.276129.	↑	SG05A	↑	27.60
6102.	↑	SG05C	↑	27.5 6307.	↑	SG05D	↑	27.67
5759.	↑	SG06B	↑	27.415932.	↑	SG06A	↑	27.41
6020.	↑	SG06C	↑	27.4 6233.	↑	SG06D	↑	27.45
5769.	↑	SG07B	↑	27.275867.	↑	SG07A	↑	27.37
6132.	↑	SG07C	↑	27.3 6418.	↑	SG07D	↑	27.50
5961.	↑	SG08B	↑	27.316029.	↑	SG08A	↑	27.48
6426.	↑	SG08C	↑	27.4 6587.	↑	SG08D	↑	27.61
6415.	↑	SG09B	↑	27.676164.	↑	SG09A	↑	27.30
5964.	↑	SG09C	↑	27.6 6057.	↑	SG09D	↑	27.23
6602.	↑	SG10B	↑	27.216249.	↑	SG10A	↑	27.45
6093.	↑	SG10C	↑	27.516265.	↑	SG10D	↑	27.41
6742.	↑	SG11B	↑	27.476209.	↑	SG11A	↑	27.40
6549.	↑	SG11C	↑	27.37 6345.	↑	SG11D	↑	27.71
6929.	↑	SG12B	↑	27.416200.	↑	SG12A	↑	27.31
6390.	↑	SG12C	↑	27.416227.	↑	SG12D	↑	27.45
6478.	↑	SG13B	↑	27.036002.	↑	SG13A	↑	27.07
6412.	↑	SG13C	↑	27.2 6510.	↑	SG13D	↑	27.20
6508.	↑	SG14B	↑	26.566327.	↑	SG14A	↑	26.23
6419.	↑	SG14C	↑	26.4 6447.	↑	SG14D	↑	26.79

5.000 0.000

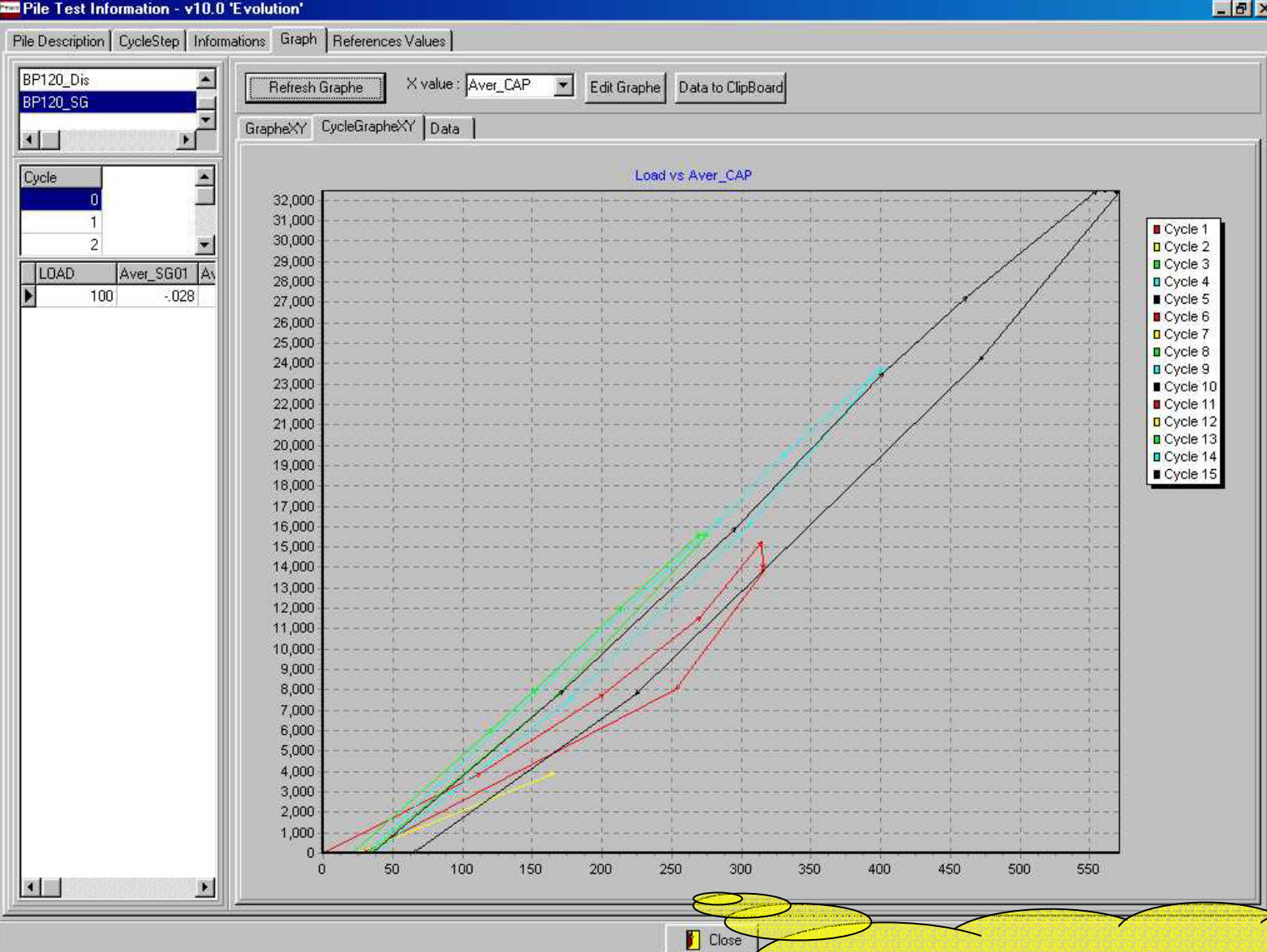
Strain Gauge locations and values. All in real time.

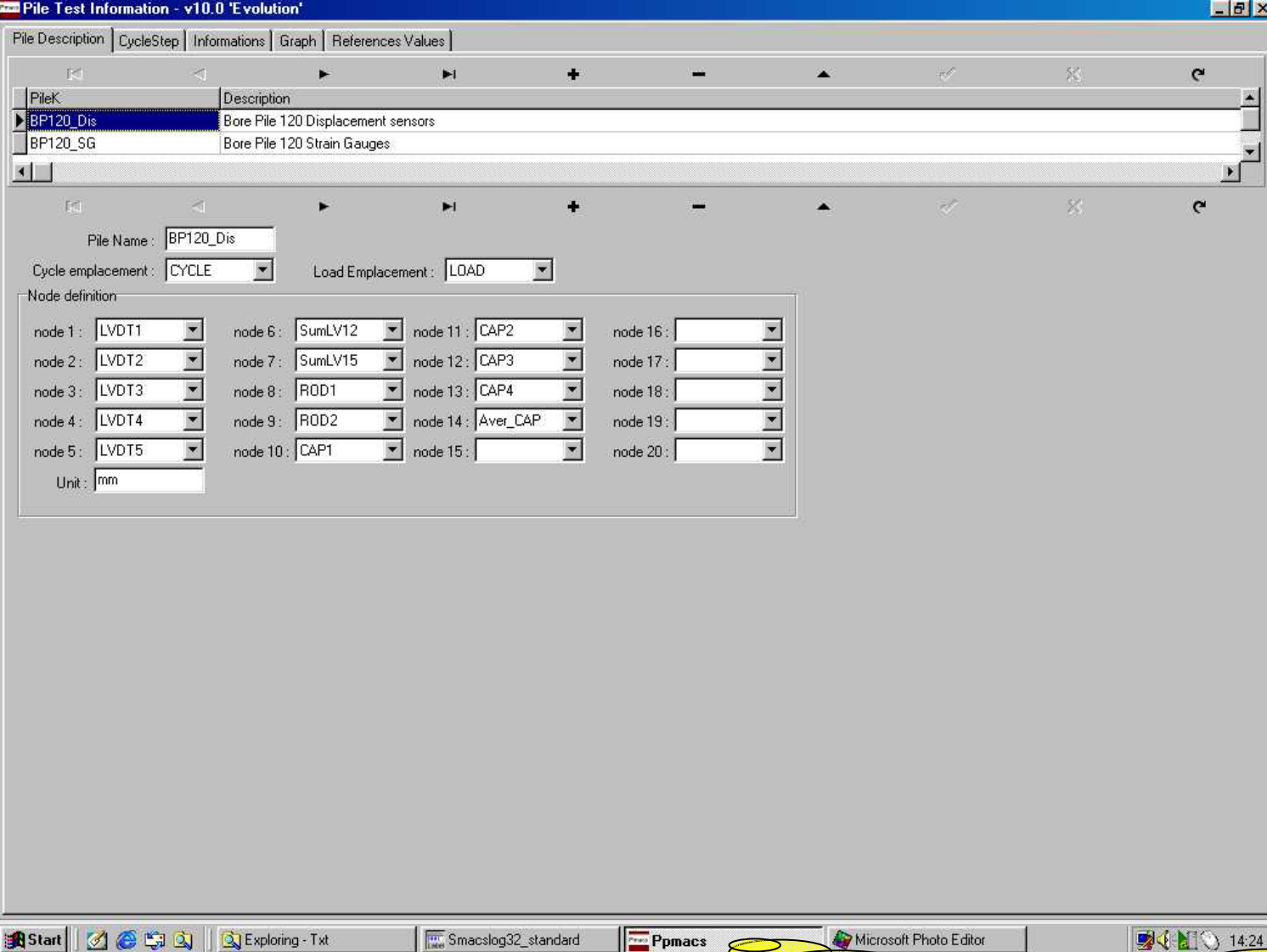


Interface show configurable views, during test cycles.



Real Time load vs. Settlement
Plots.





Easy to use interface,
configurable to view all critical
information during the test.

File Test Information - v10.0 'Evolution'

File Description CycleStep Informations Graph References Values

File Name: BP120_Dis Apply updates

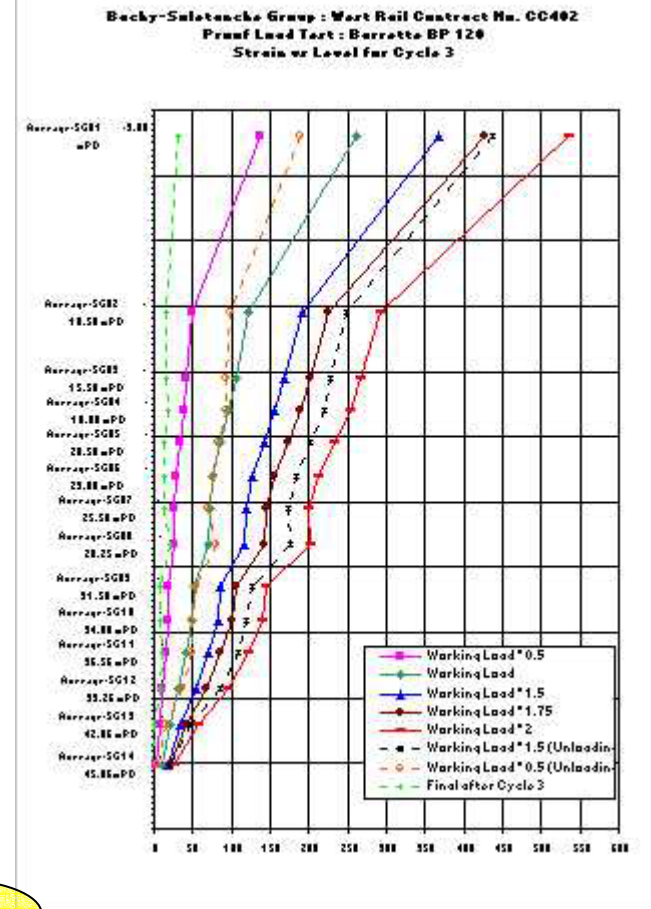
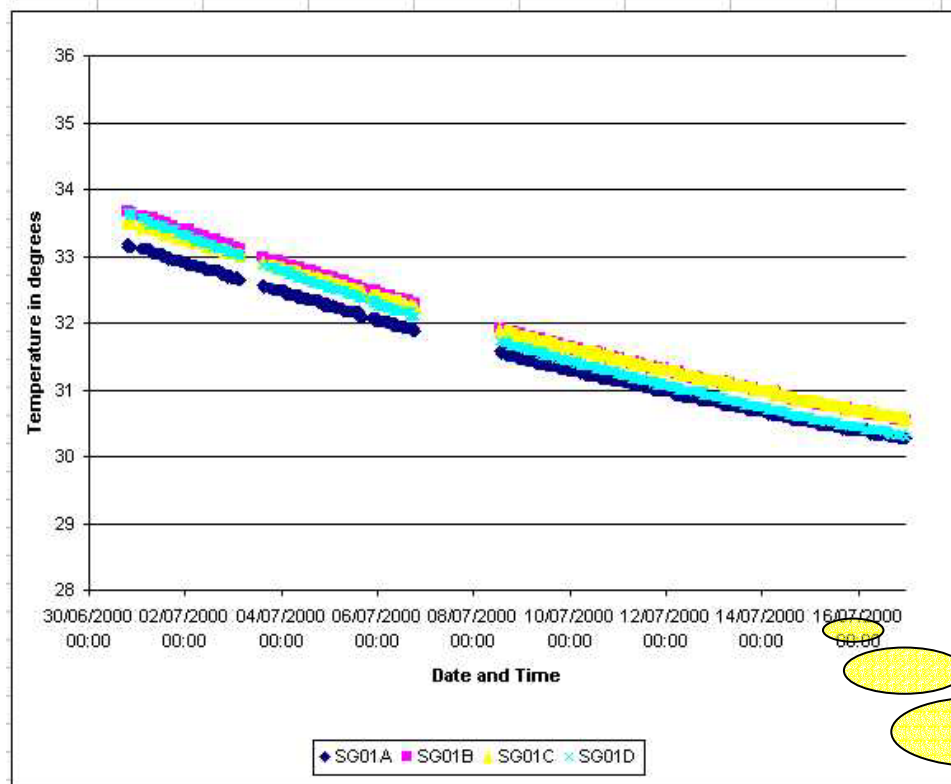
21/07/2000 14:09:00 Nearest acquisition cycle: --/--/-- --:--:--

Cycle number: 5 Load: 0

Cycle	DateHeure	LOAD	LVDT1	LVDT2	LVDT3	LVDT4	LVDT5	SumLV12	SumLV15	RDD1	RDD2	CAP1	CAP2	CAP3
0	04/07/2000	0	8709896E18	.001	-.002	.002	-.005	.001	-.004	-.019	-.037	-.018	-.006	-.067
1	04/07/2000	0	8709896E18	.003	-.003	-.002	.000	.003	-.002	-.077	-.079	-.022	-.008	-.076
1	04/07/2000	3891	8709896E18	.314	.199	.12	.019	.314	.652	.601	1.211	1.918	1.797	2.423
1	04/07/2000	7805	8709896E18	.692	.444	.281	.041	.692	1.458	1.644	3.032	4.65	4.657	5.041
1	05/07/2000	11593	8709896E18	1.01	.705	.427	.064	1.01	2.207	2.54	4.613	7.068	7.225	7.52
1	05/07/2000	15233	8709896E18	1.225	.877	.545	.08	1.225	2.727	3.231	5.592	8.809	8.97	9.206
1	05/07/2000	13980	8709896E18	1.23	.886	.556	.081	1.23	2.754	3.174	5.571	8.937	9.077	9.347
1	05/07/2000	13805	8709896E18	1.23	.885	.556	.081	1.23	2.753	3.161	5.559	8.946	9.102	9.391
1	05/07/2000	8000	8709896E18	1.061	.802	.493	.067	1.061	2.424	3.122	5.539	7.571	7.459	8.359
1	05/07/2000	0	8709896E18	.17	.192	.117	-.005	.17	.475	1.019	3.204	.187	.016	.917
2	06/07/2000	0	8709896E18	.173	.18	.113	-.004	.173	.461	.697	2.913	-.139	-.336	.607
2	06/07/2000	3892	8709896E18	.545	.401	.263	.023	.545	1.232	1.226	3.841	3.324	3.353	4.01
2	06/07/2000	0	8709896E18	.166	.188	.118	-.003	.166	.469	.801	2.93	-.178	-.372	.537
3	10/07/2000	0	8709896E18	.168	.177	.131	.000	.168	.476	.477	2.665	.037	.045	.005
3	10/07/2000	6048	8709896E18	.398	.31	.221	.015	.398	.944	.788	3.215	2.167	2.355	2.195
3	10/07/2000	8026	8709896E18	.518	.387	.256	.021	.518	1.183	1.025	3.522	3.046	3.214	2.968
3	10/07/2000	12047	8709896E18	.748	.551	.359	.04	.748	1.698	1.682	4.294	5.041	5.178	4.853
3	10/07/2000	15648	8709896E18	1.033	.749	.465	.062	1.033	2.308	2.521	5.174	7.031	7.124	6.773
3	11/07/2000	15634	8709896E18	1.049	.779	.496	.068	1.049	2.391	2.638	5.324	7.148	7.226	7.027
3	11/07/2000	7598	8709896E18	.714	.571	.36	.035	.713	1.683	2.296	4.831	4.247	4.344	4.142
3	11/07/2000	0	8709896E18	.212	.232	.144	-.004	.212	.583	.956	3.376	.276	.306	.153
4	11/07/2000	0	8709896E18	.206	.226	.136	-.006	.206	.562	.956	3.355	.217	.251	.086
4	11/07/2000	16350	8709896E18	1.081	.793	.494	.063	1.081	2.43	2.895	5.611	7.443	7.56	7.254
4	12/07/2000	19611	8709896E18	1.312	.97	.597	.082	1.312	2.961	3.534	6.343	9.323	9.47	9.047
4	12/07/2000	23830	8709896E18	1.631	1.247	.761	.109	1.631	3.748	4.49	7.713	12.41	12.481	12
4	12/07/2000	16052	8709896E18	1.375	1.076	.662	.087	1.375	3.2	4.215	7.406	9.635	9.698	9.306
4	12/07/2000	7546	8709896E18	.783	.65	.413	.035	.783	1.882	2.599	6.096	5.369	5.43	5.006
4	12/07/2000	0	8709896E18	.212	.235	.149	-.009	.212	.588	.889	4.225	.801	.903	.536

Close

Raw data values, stored on database for back analysis, or export to generic software.



Frequency , Temperature data
 all available for the complete
 analysis of test data in real time
 or for back analysis

Smacs Log XY

1 SumLV15

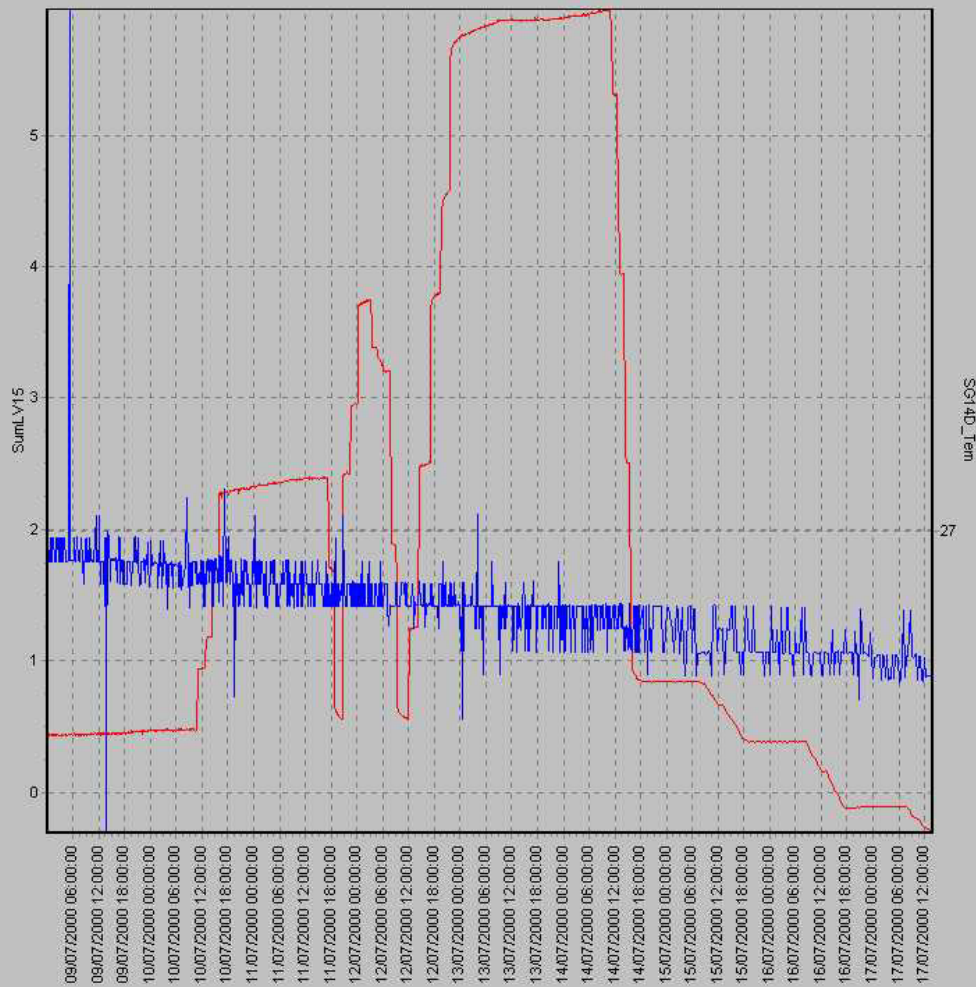
2 SG14D_Tem

Time Graph Scale

Auto Minimum Maximum

1 ☒ 0.00 0.002 ☒ 0.00 0.00

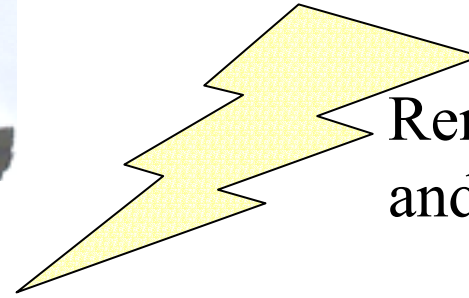
Graph type

☒ Time Graph☐ Graph XY

Sol Data

Cross reference of data real
time

GEOCAM



Remote connection
and monitoring

The PC manages the remote camera(s), and stores the digitised images.
The software includes options for:-

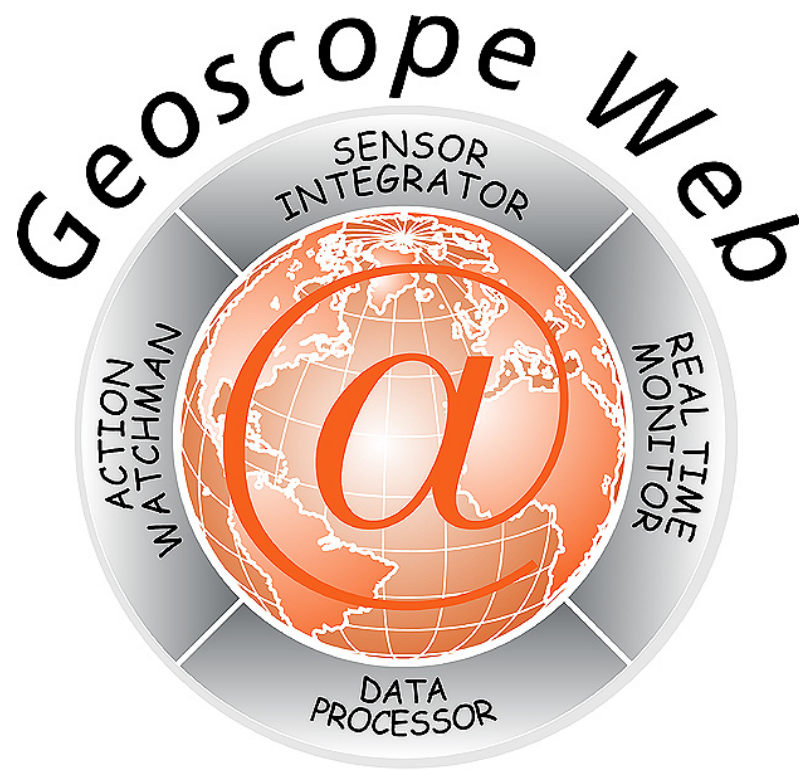
- Automatic connection to record a picture of the site at pre-set intervals
- Automatic start-up in response to data provided by external sensor(s)
- Remote control of the camera, by "Soft stick" - to adjust azimuth, elevation, focus, zoom, etc.

Up to 4 GeoCam systems can be connected to the same computer allowing simultaneous monitoring of 4 sites.

Sol Data

PART 2

Real-Time Monitoring of Structures

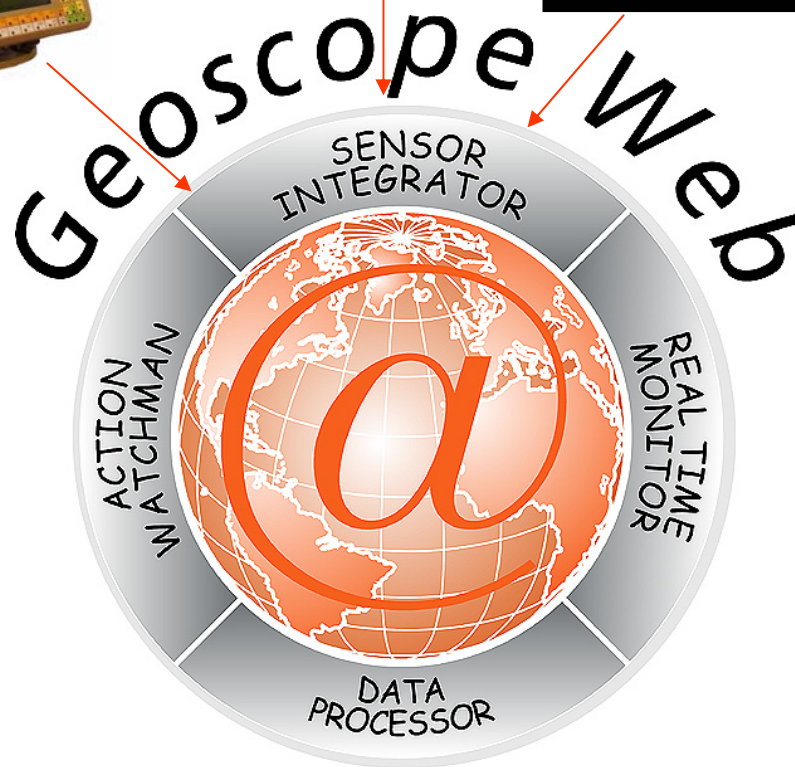




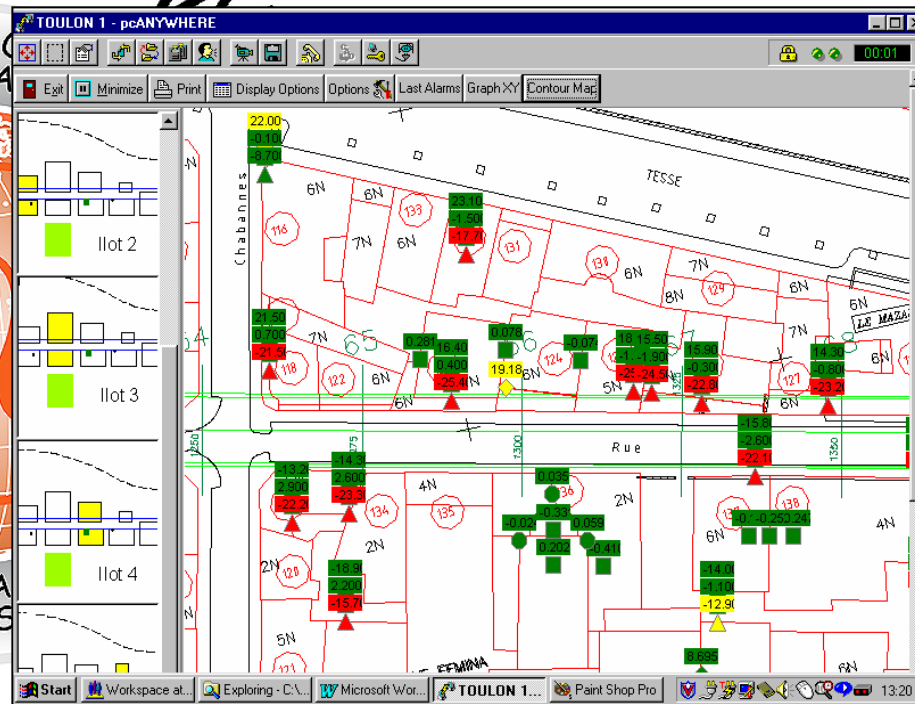
Tilt-meters



Settlement Cells

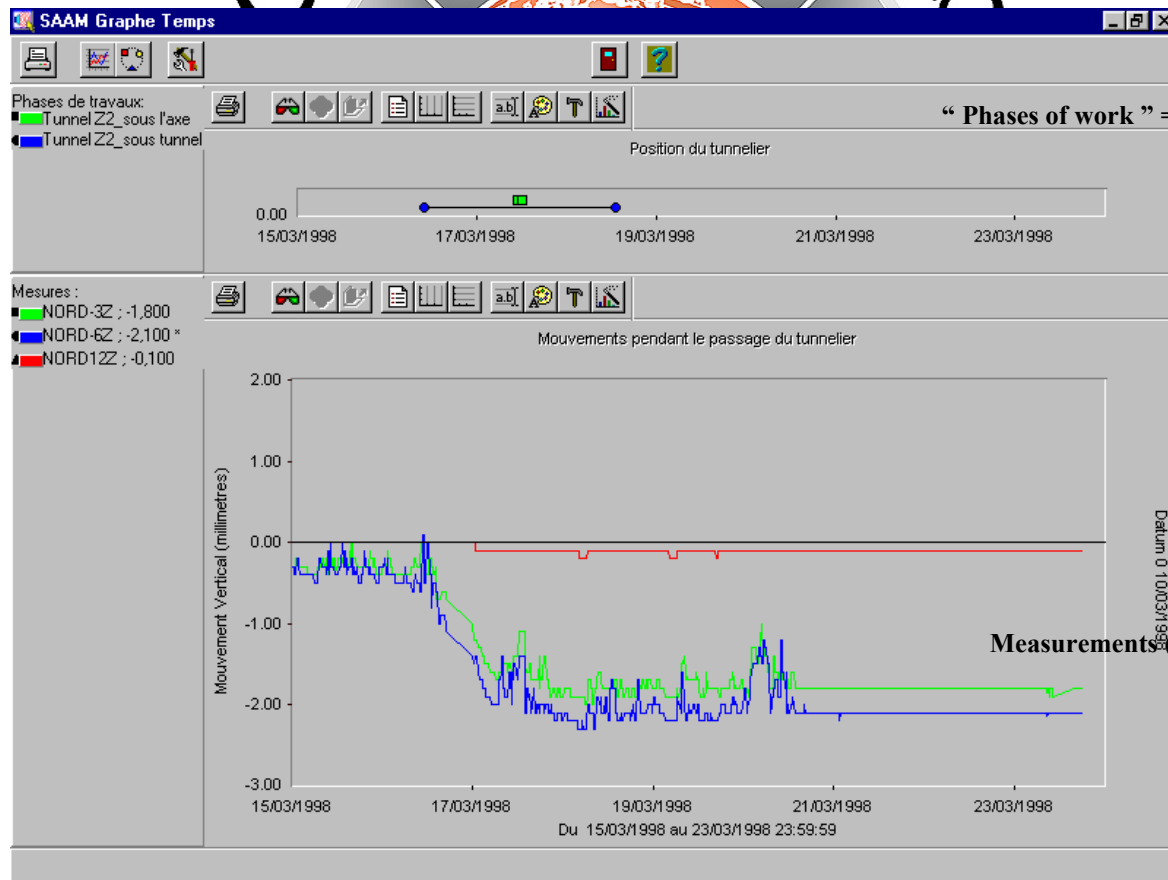


Geoscope 14

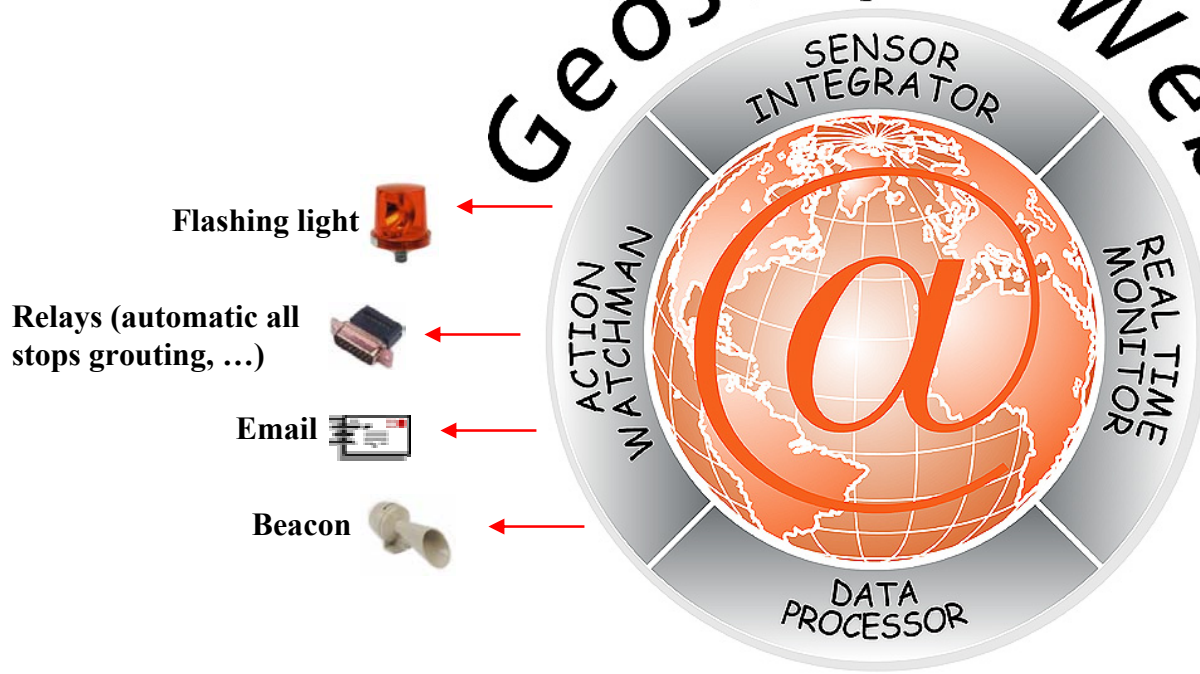


Geoscope Web

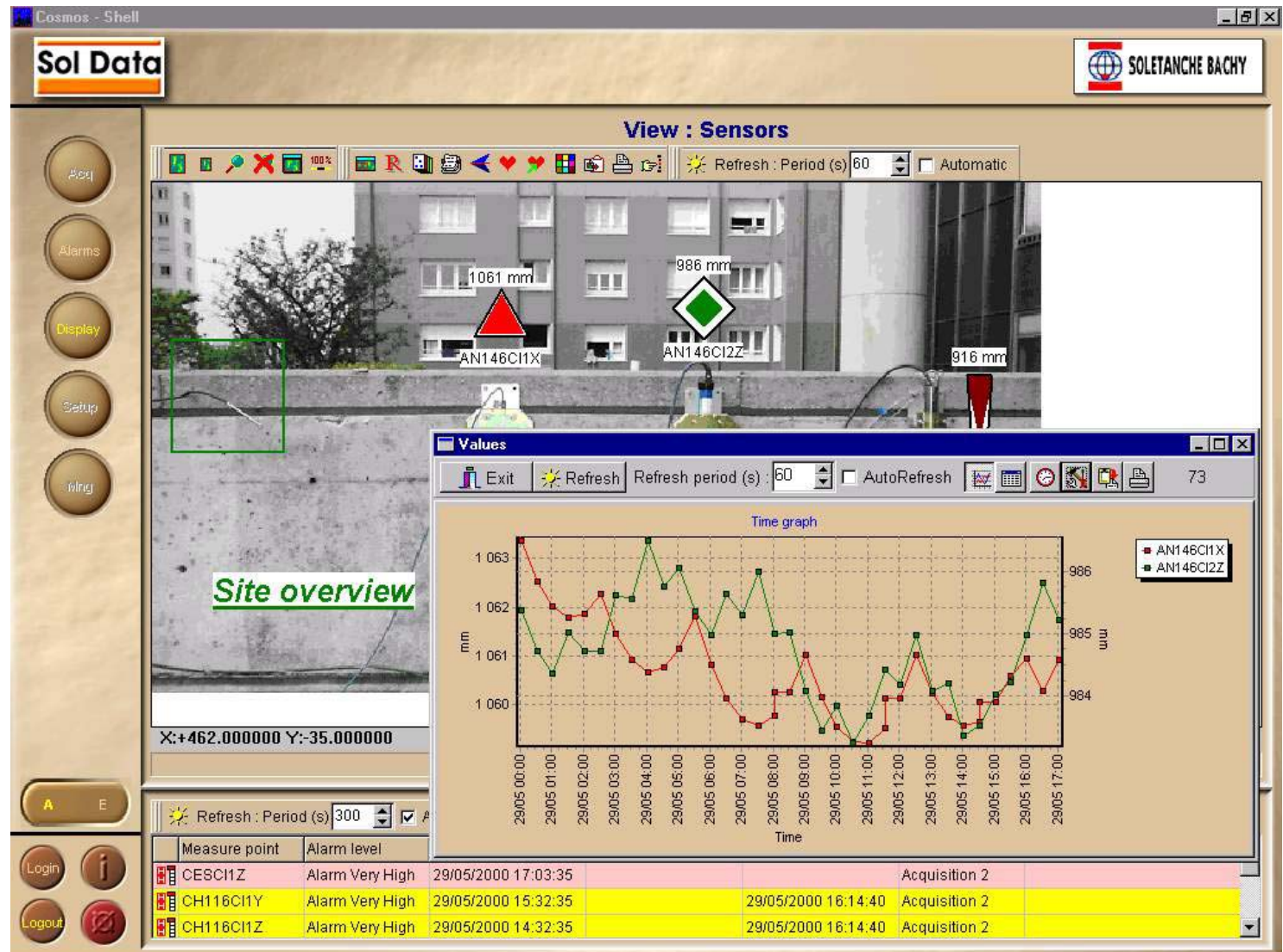
SENSOR INTEGRATOR



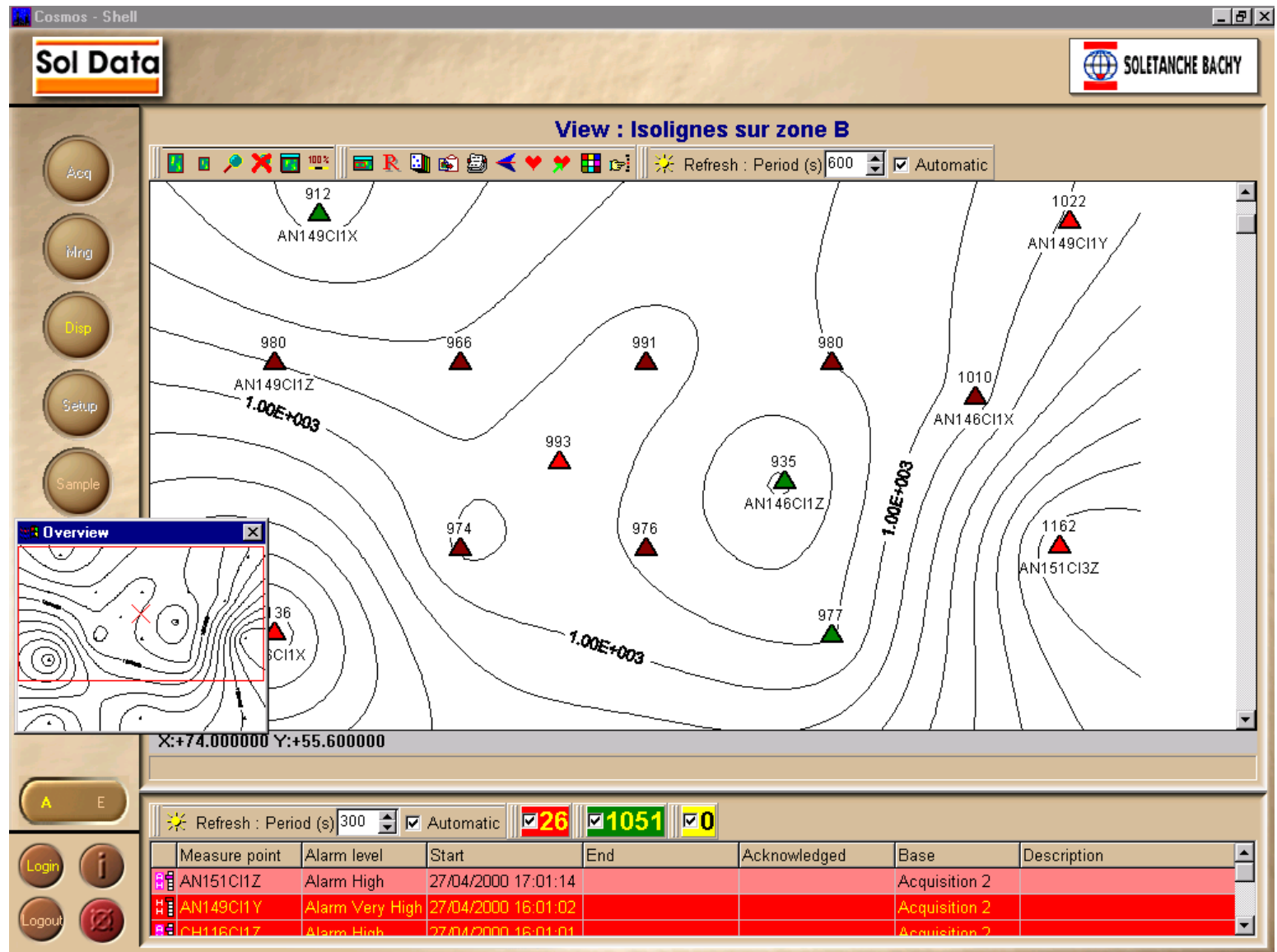
Geoscope Web



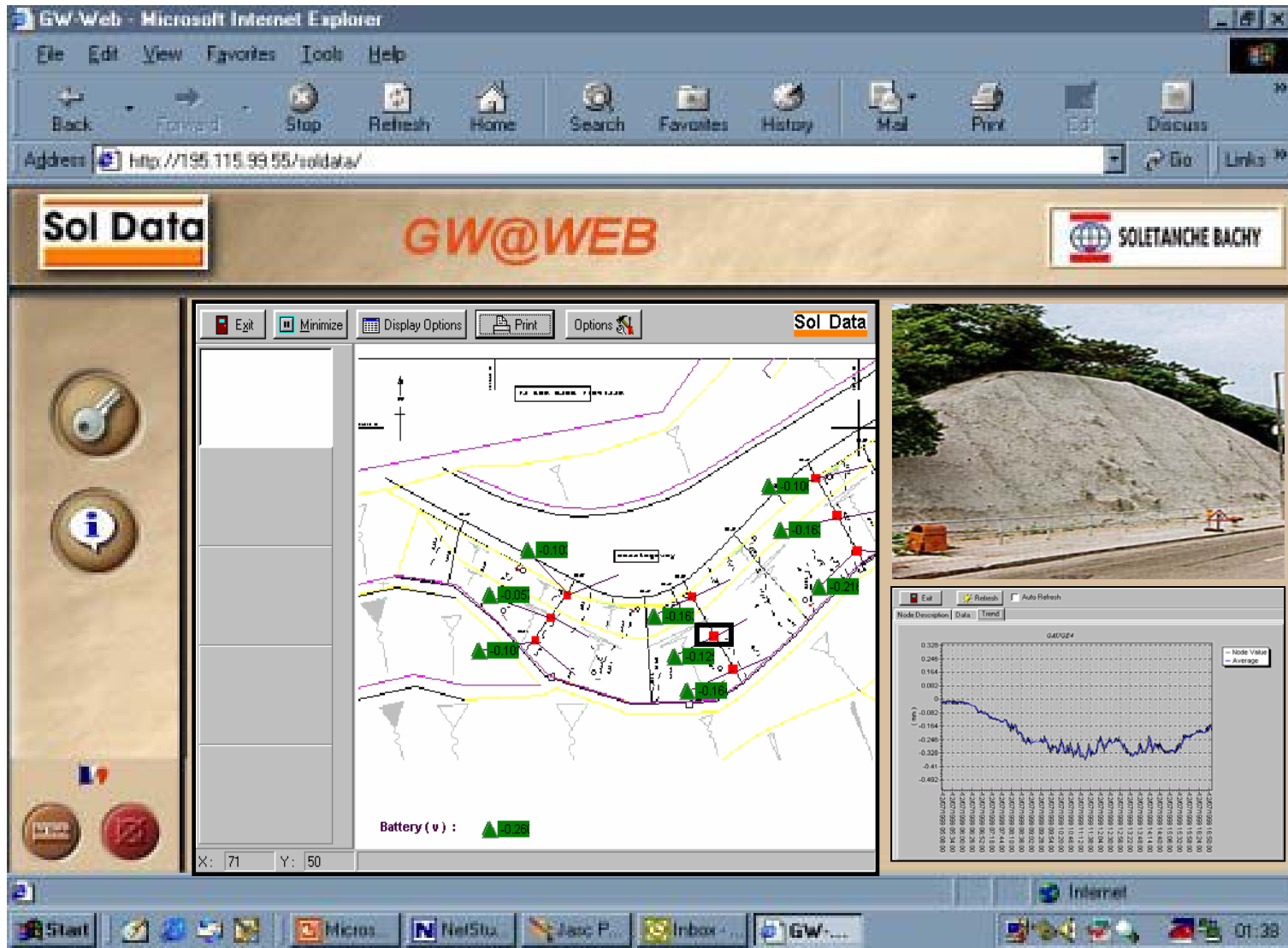
GW@Observer: multiple time graphs can be obtained by clicking on sensors icons



GW@Observer: isolines of settlements, obtained in real time (note the overview window showing the position of the active window in the whole site)

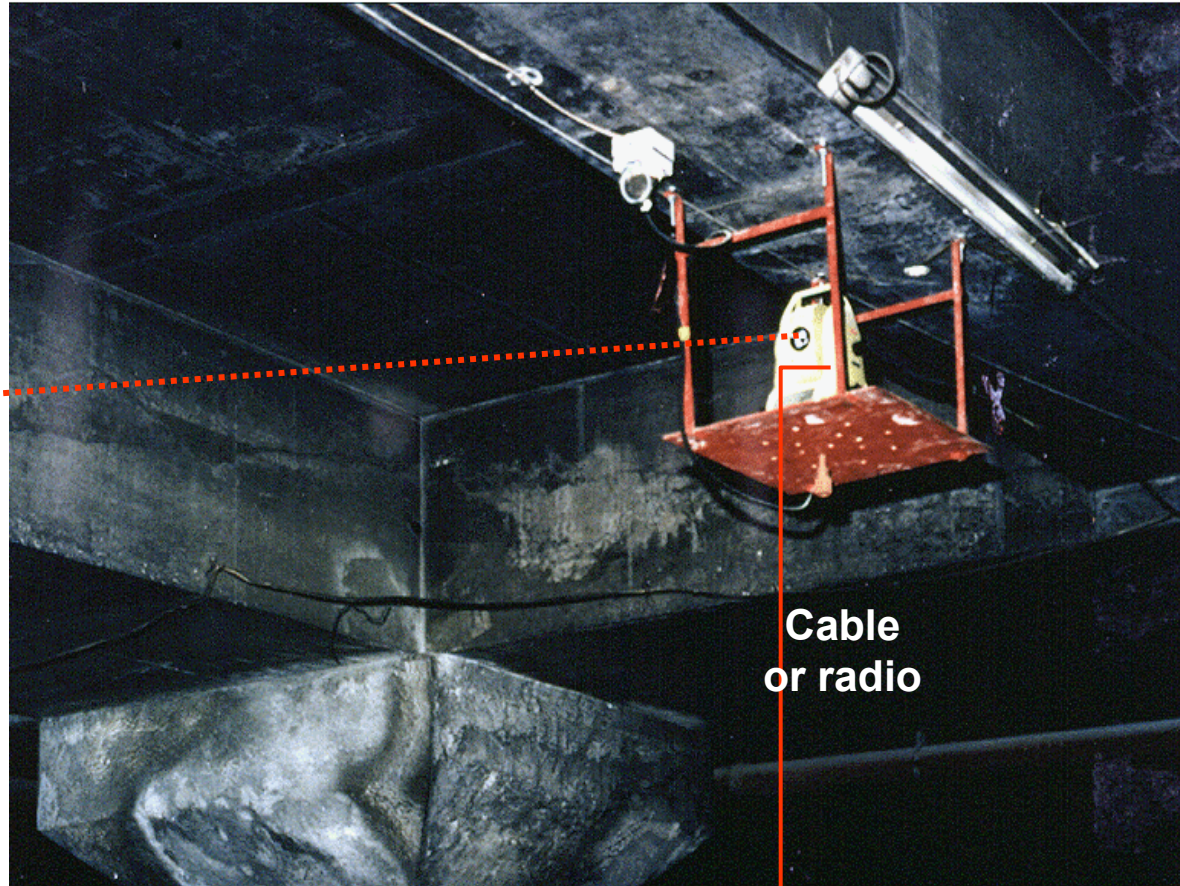
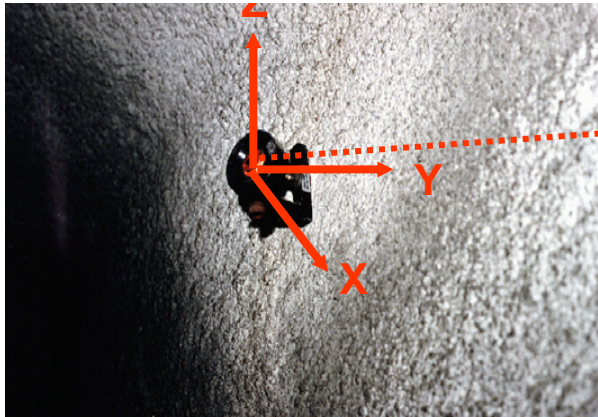


Remote Access Via The Internet



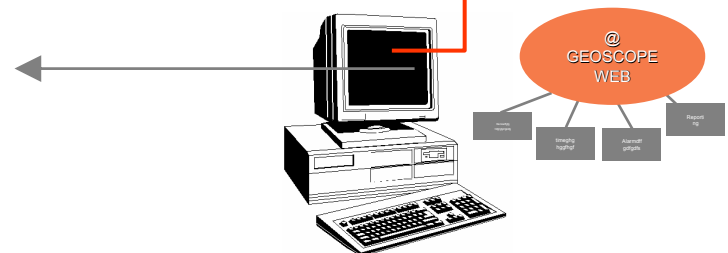
CYCLOPS= CYCLic OPTical Surveyor

Accuracy =
1 mm at 100 m

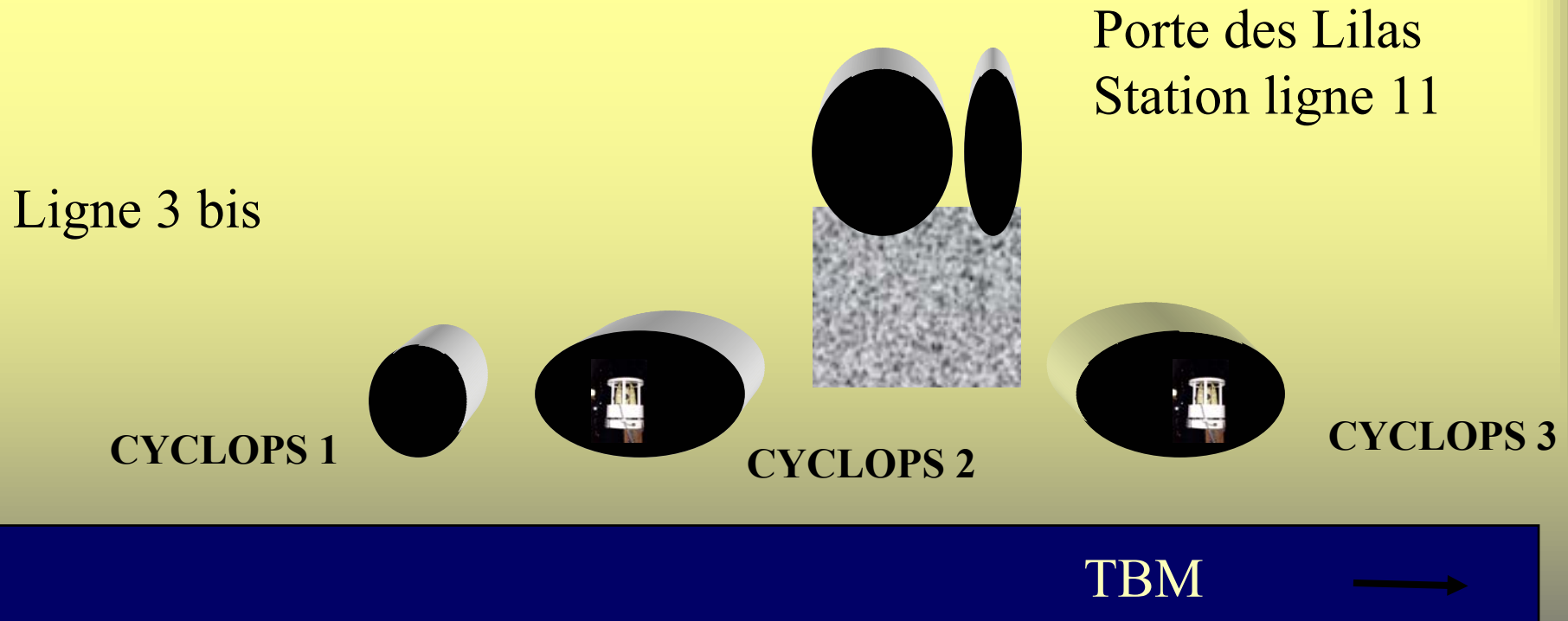


Cable
or radio

REAL TIME MONITORING
AND REPORTING



Tunnel monitoring : Metro Paris



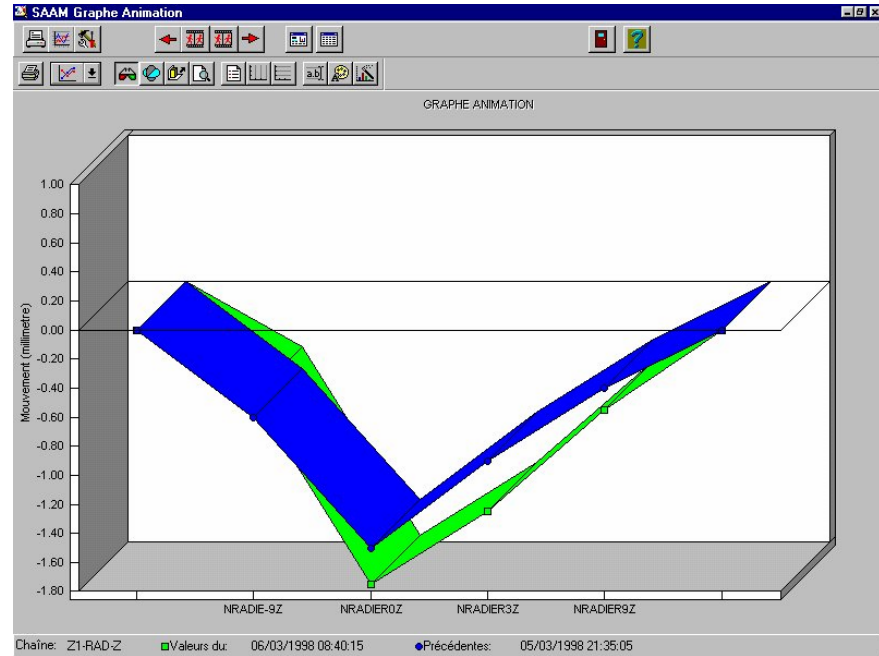
Other ex : Rouen metro , Montretout railways

Tunnel monitoring: Metro Paris

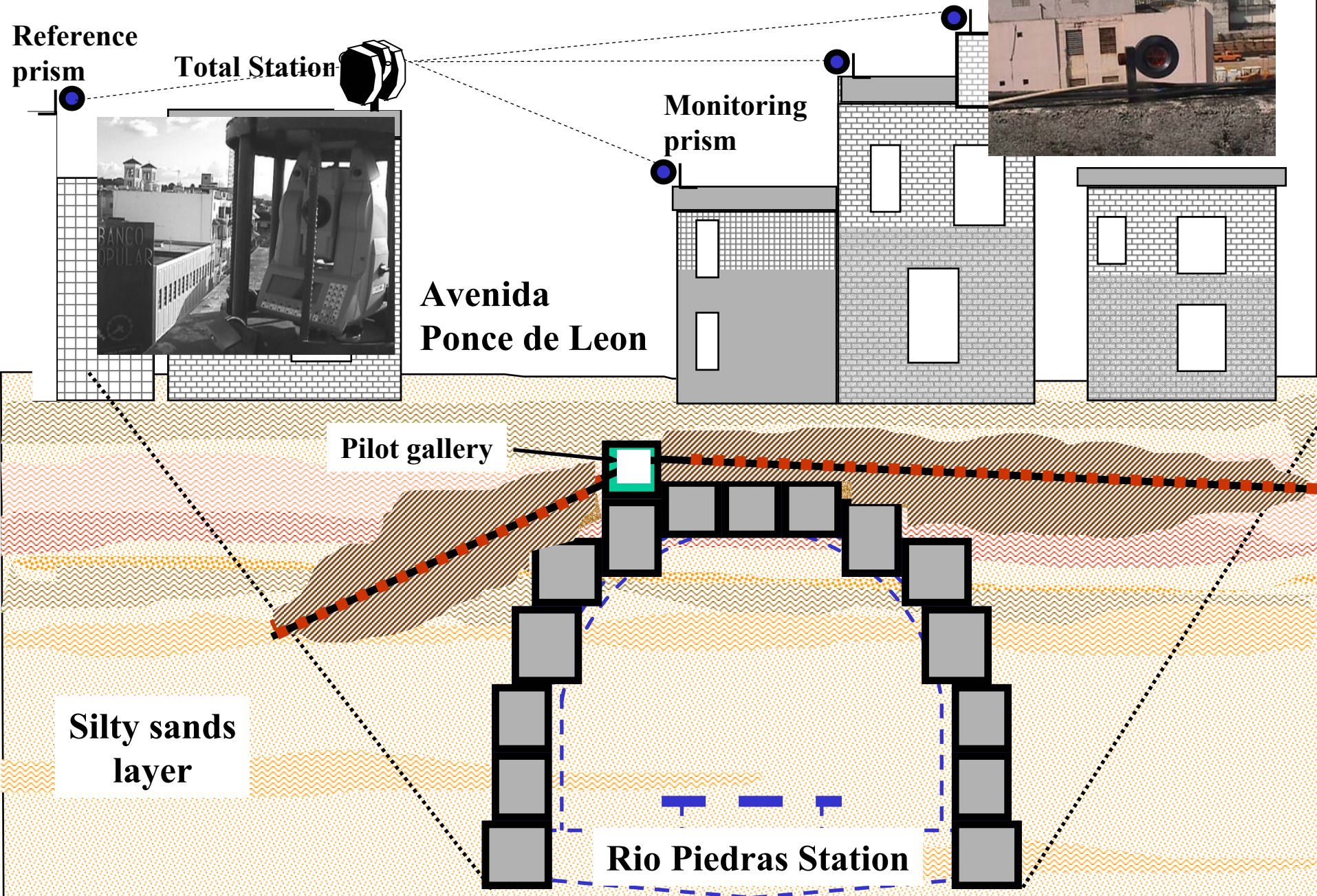
CYCLOPS

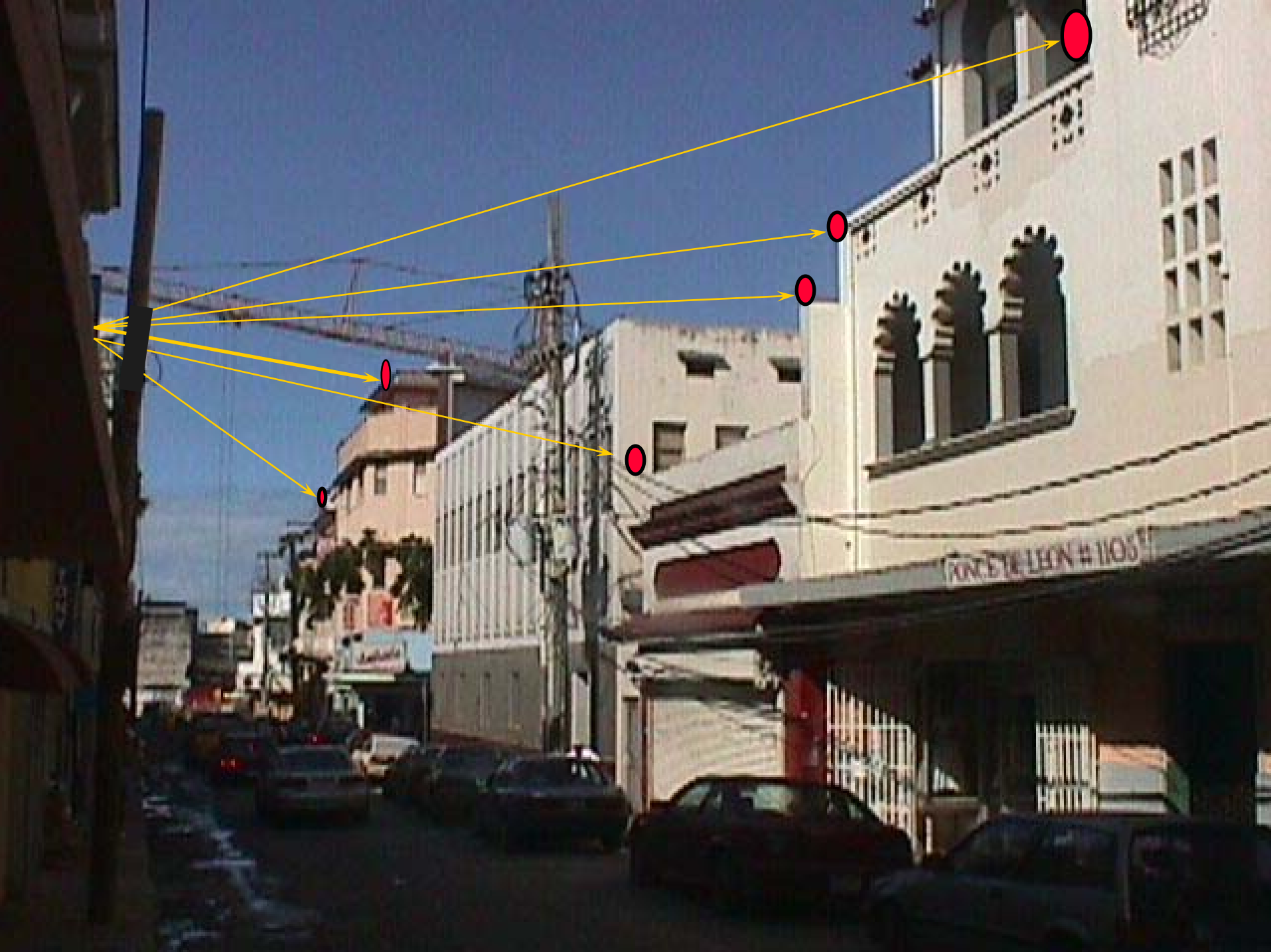


TBM



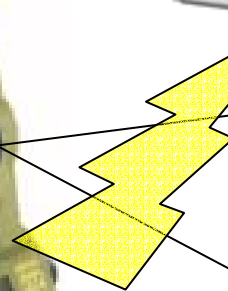
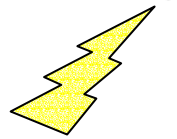
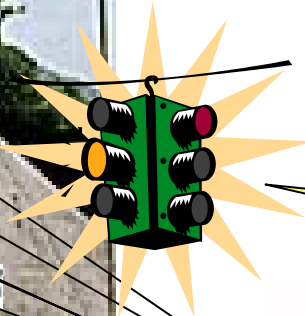
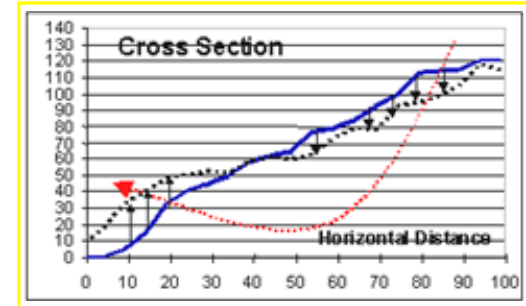
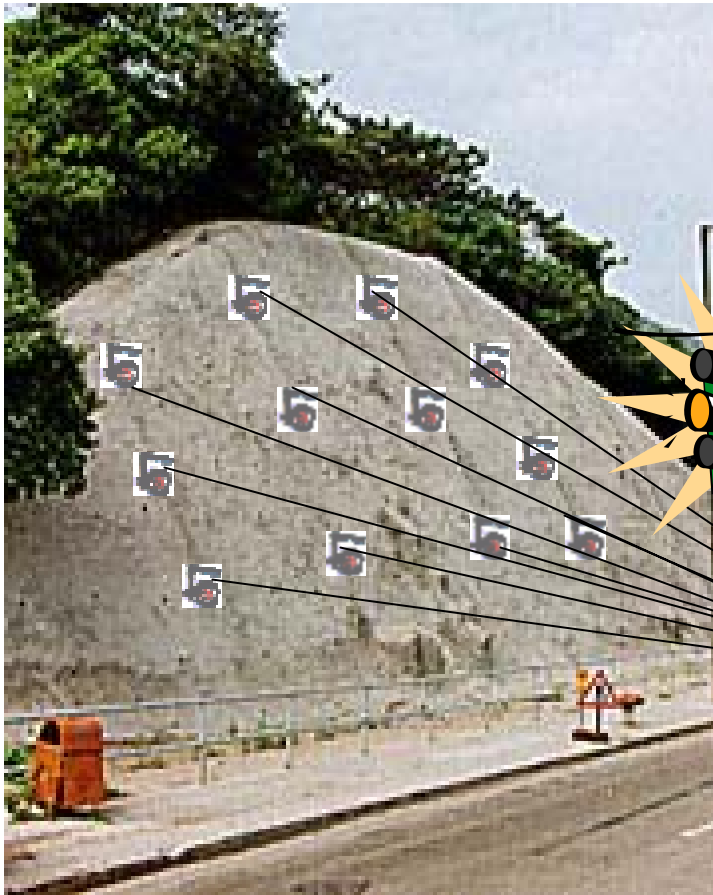
Rio Piedras - San Juan - Puerto Rico

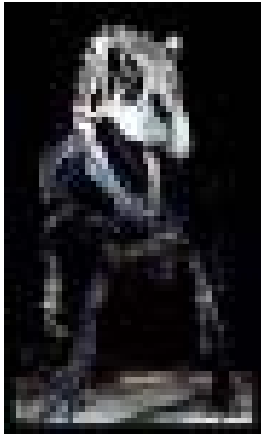




CYCLOPS

Sol Data





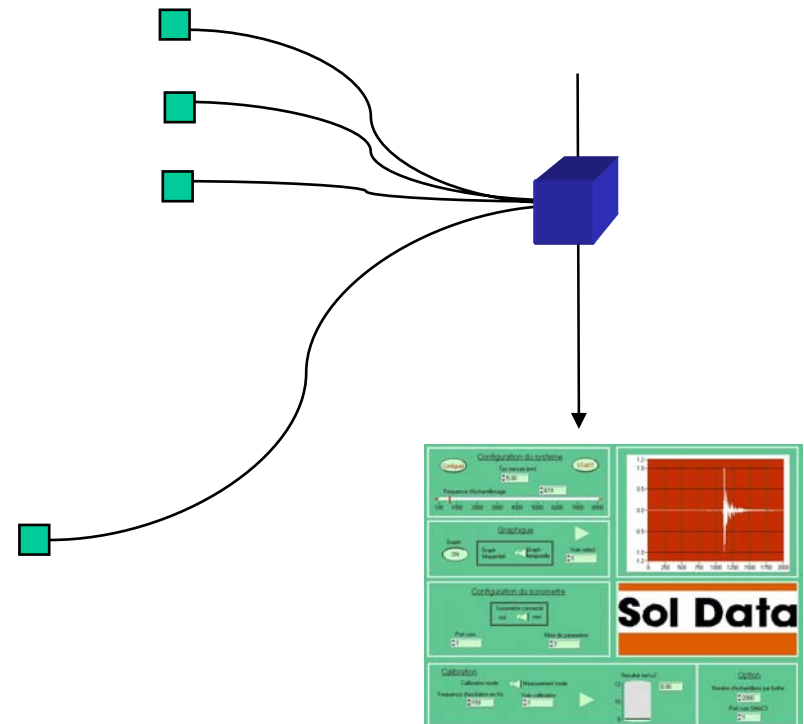
Smithsonian Institute (DC)



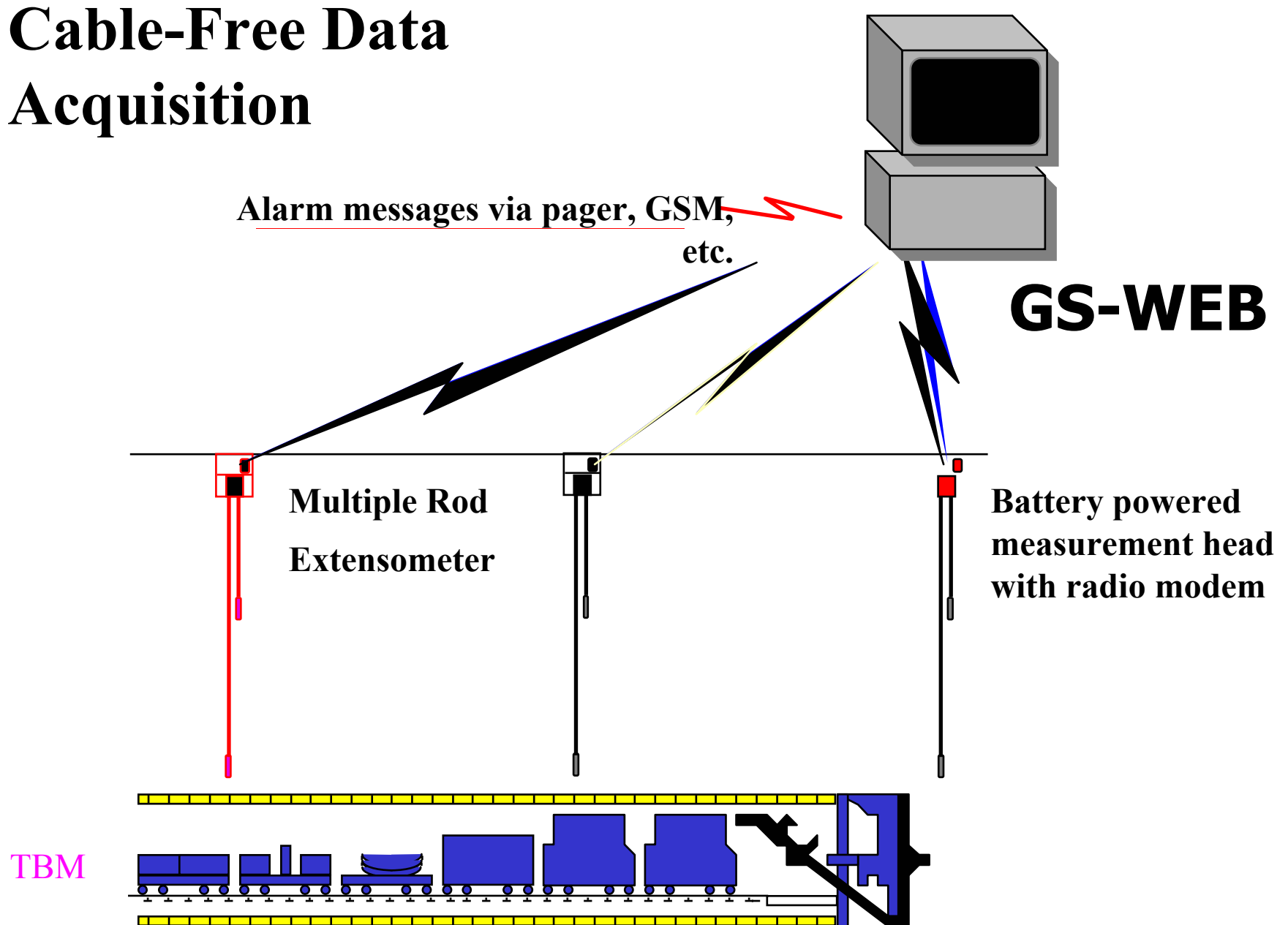
Sol Data

GORGONE

**Noise & Vibration
Monitoring**



Cable-Free Data Acquisition



Sol Data

PART 3

Real-Time Monitoring Case Histories

PLAVINAS DAM (Latvia)

**Turnkey instrumentation system
for real time monitoring and
behaviour analysis**

PLAVINAS DAM - Daugava River (Republic of Latvia)

the most important dam in the country, supplying 30 % of power in Latvia.



Plaviņu HES

Project Conditions

- A dam founded in moraines with a sandstone layer below.
- Sandstone feeds moraine with water, creating up lift pressure, causing the concrete structure to slide downstream.
- Water washing out fine material potentially causing settlements.

Purpose of the instrumentation

- Safety of the dam
- Analysis of structure behaviour to define adequate remedial works

by

- Replacement, upgrading and complement of the existing instrumentation
- Installation of an automatic data acquisition system
- Installation of a software with a database for data processing and reporting

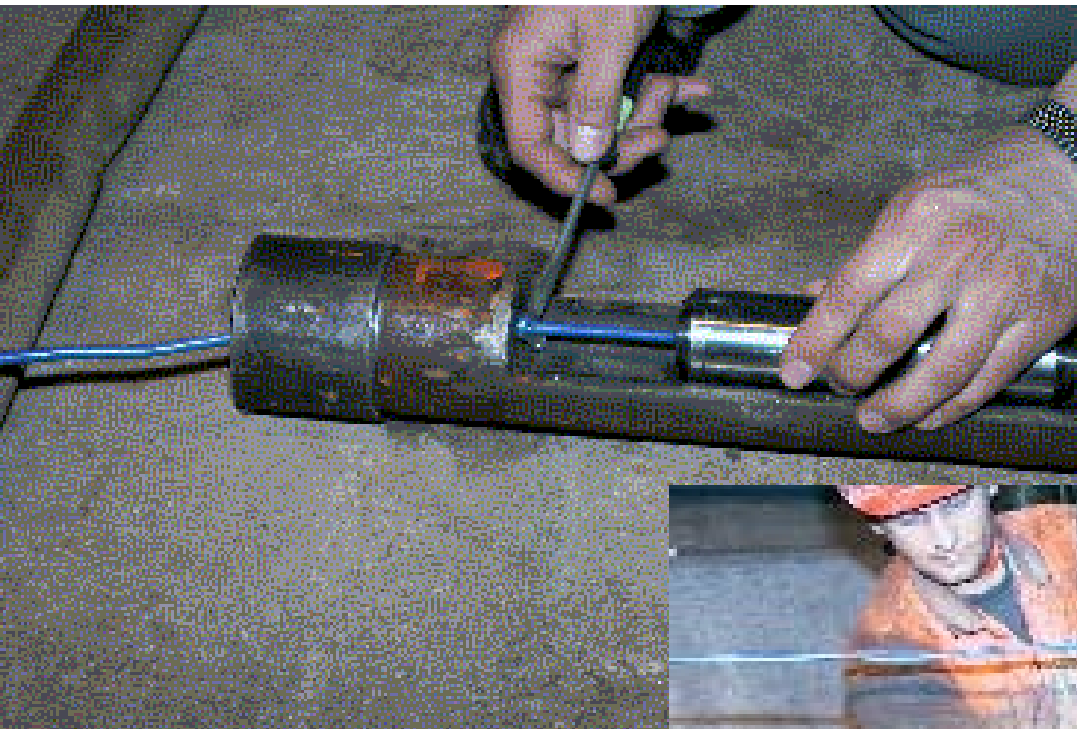


drilling inside (filter room) (Puntel PX609+ Top Hammer).

- 3 sequences :
- coring through Concrete
 - temporary dosapro valve
 - roto percussion method



embedded piezometers : Cable protected by a metallic tube



Crackmeters



Tiltmeters



Trenching and Cabling

28 000 m of signal cables (sensor->AM416)

12 000 m of communication cables (AM416->CR10)

2 000 m of 220V cable

15 000 m of copper wire for lightening protection

5 000 m of trenches

4 000 m of cable trays

CR10 in IP66 Cabinet



Control Room



Means

- 2 permanent engineers during 6 months
- 2 local workers and local sub-contractors for trenching, cabling, ...
- 3 drilling machines with operators and one engineer during 3 months
 - ⇒ Drilling up to 45 meters from galleries inside the dam for installation of piezometers,
 - ⇒ Drilling up to 120 meters outdoors for installation of piezometers and in-place-inclinometers,
- 2 years warranty after reception
- Budget > 1 millions US\$

AMSTERDAM

**THE CITY
under**

Real-Time Monitoring

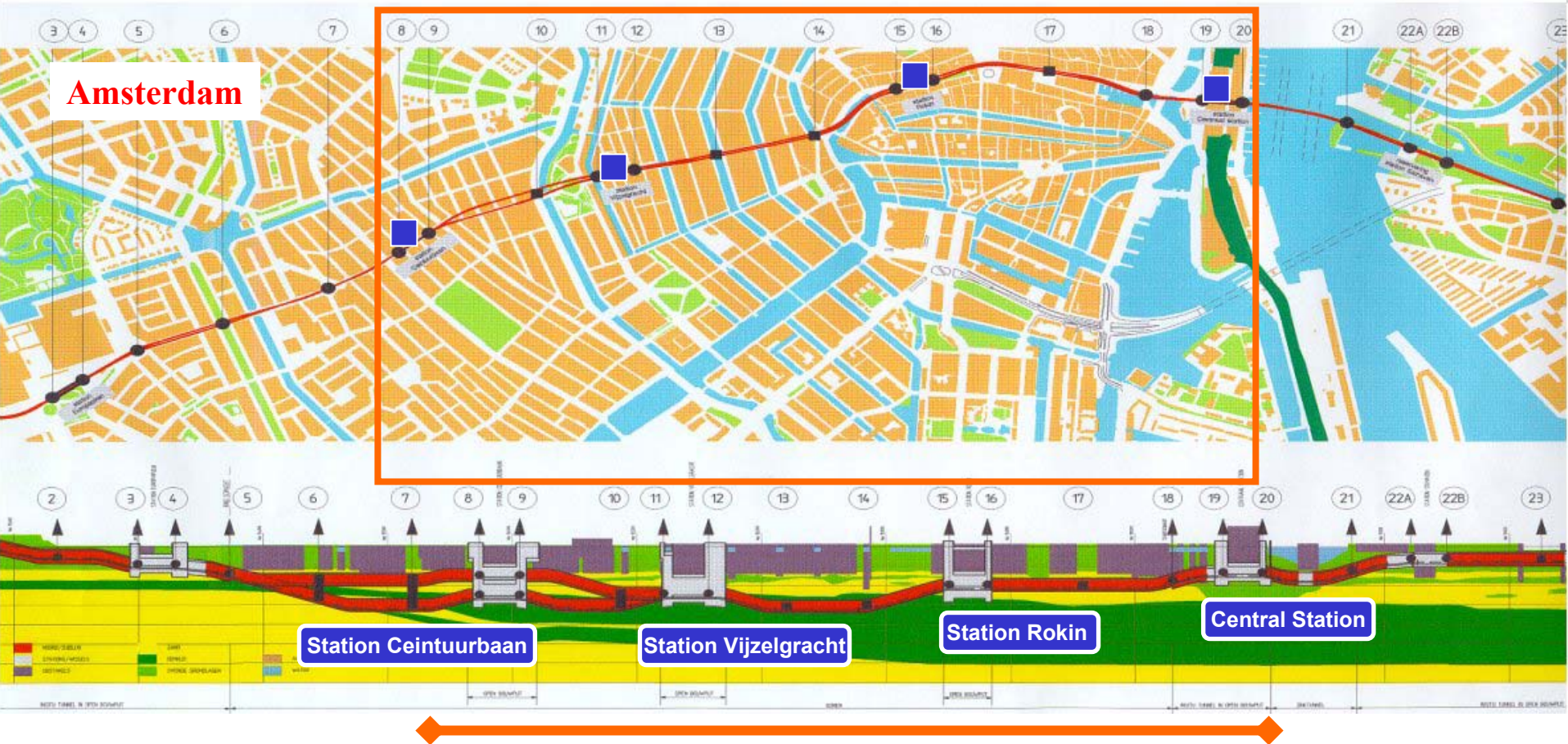




Amsterdam

Alignment North/South Line

noord/zuidlijn



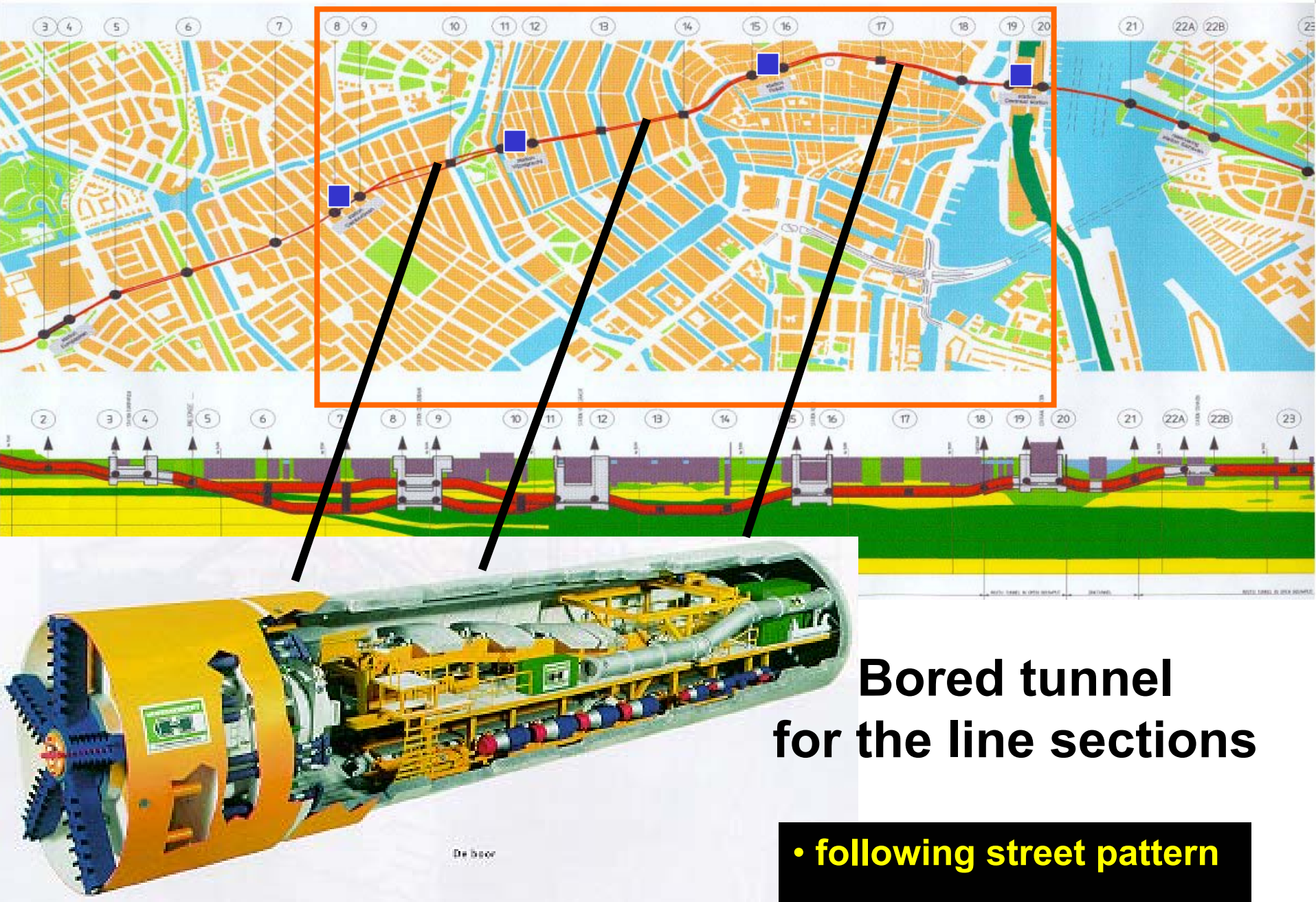
Phase I of works :

- 3,9 km of tunnel
- 4 stations

79 CYCLOPS

3000 Instruments

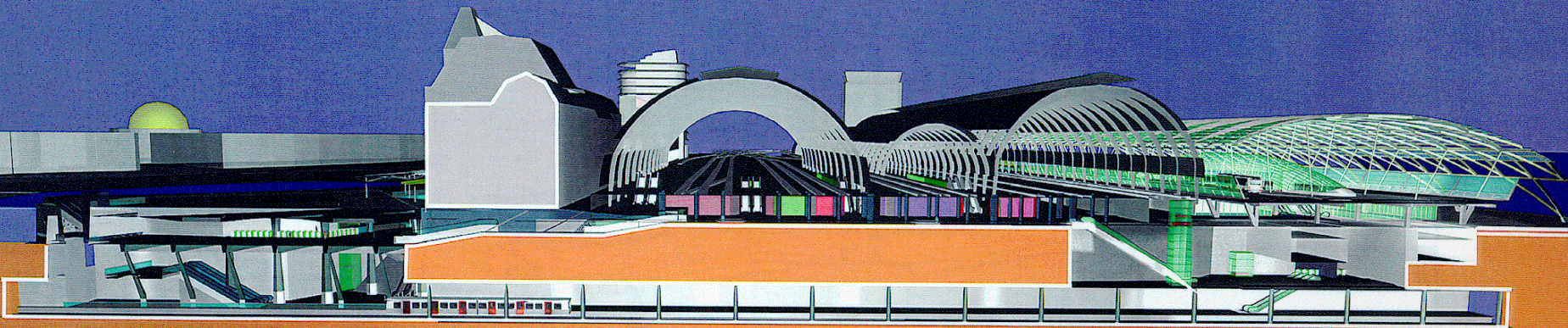
Sol Data



Bored tunnel for the line sections

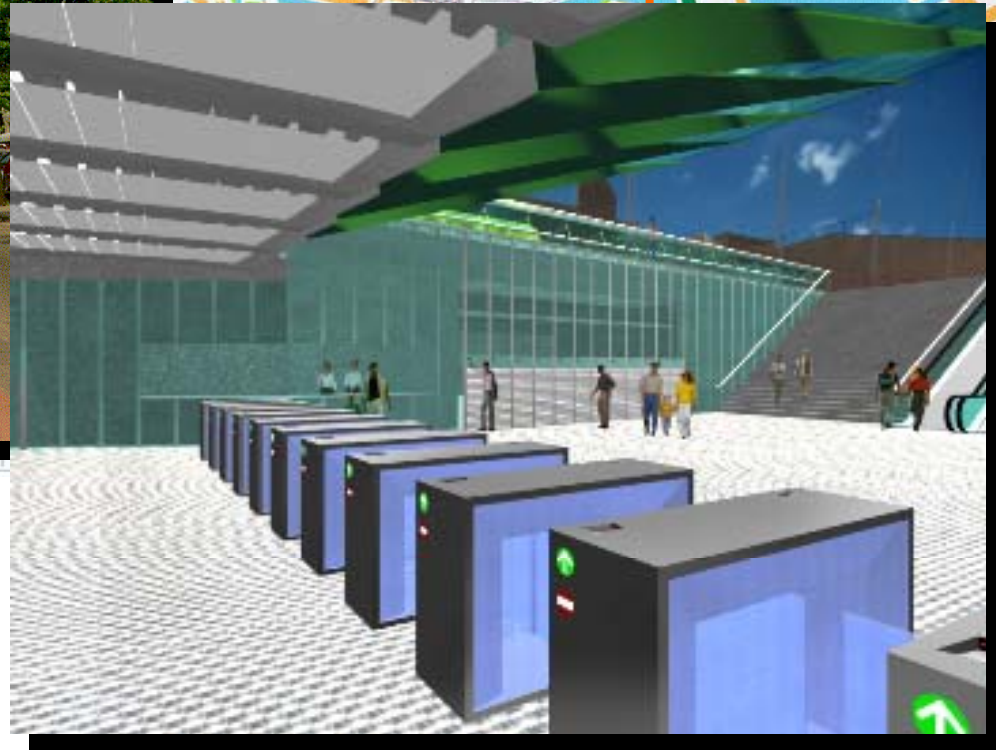
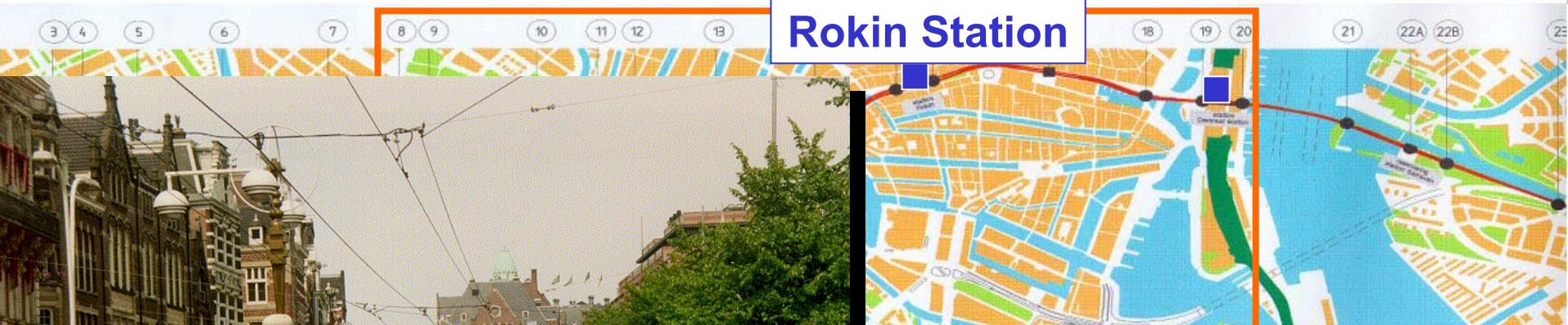
- following street pattern
- lowered to a great depth

Central Station



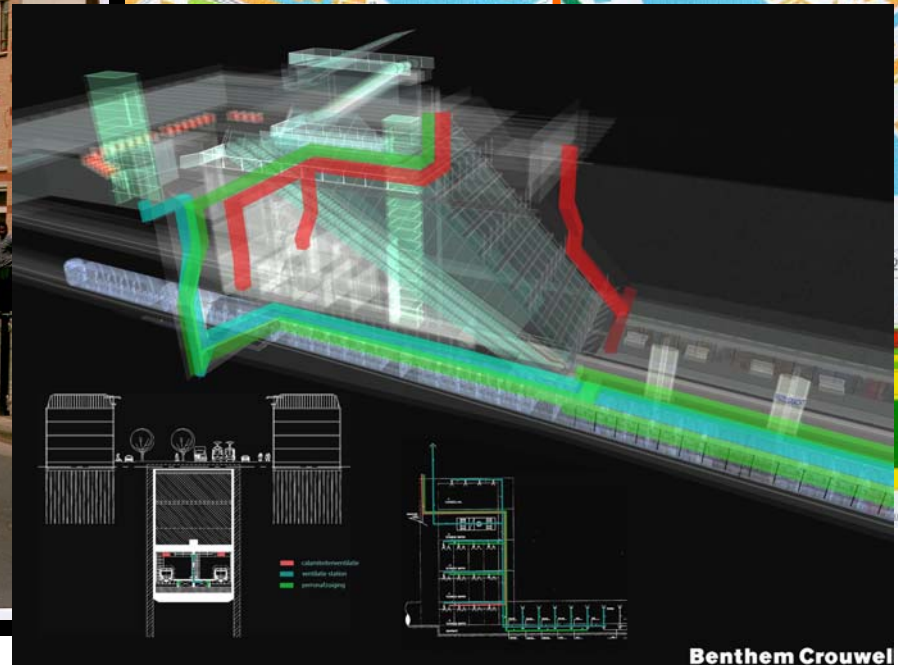
Excavation 19 m

Rokin Station



Excavation 26 m

Vijzelgracht Station



Excavation 31 m

Ceintuurbaan Station



Excavation 31 m



Instruments Selected (10 000 Sensors)

- **Cyclops (80 total stations - 6 000 prims)**
- **In-Place Inclinometers (2 000 in total, 1 000 moved - 9 000 m of casing)**
- **Extensometers (160 multiple head with 400 sensors, 300 moved - 700 packers)**
- **Piezometers (50 piezometers)**
- **Electrolevels (200)**
- **Strain Gauges (700)**

Automatic Surface Instrumentation



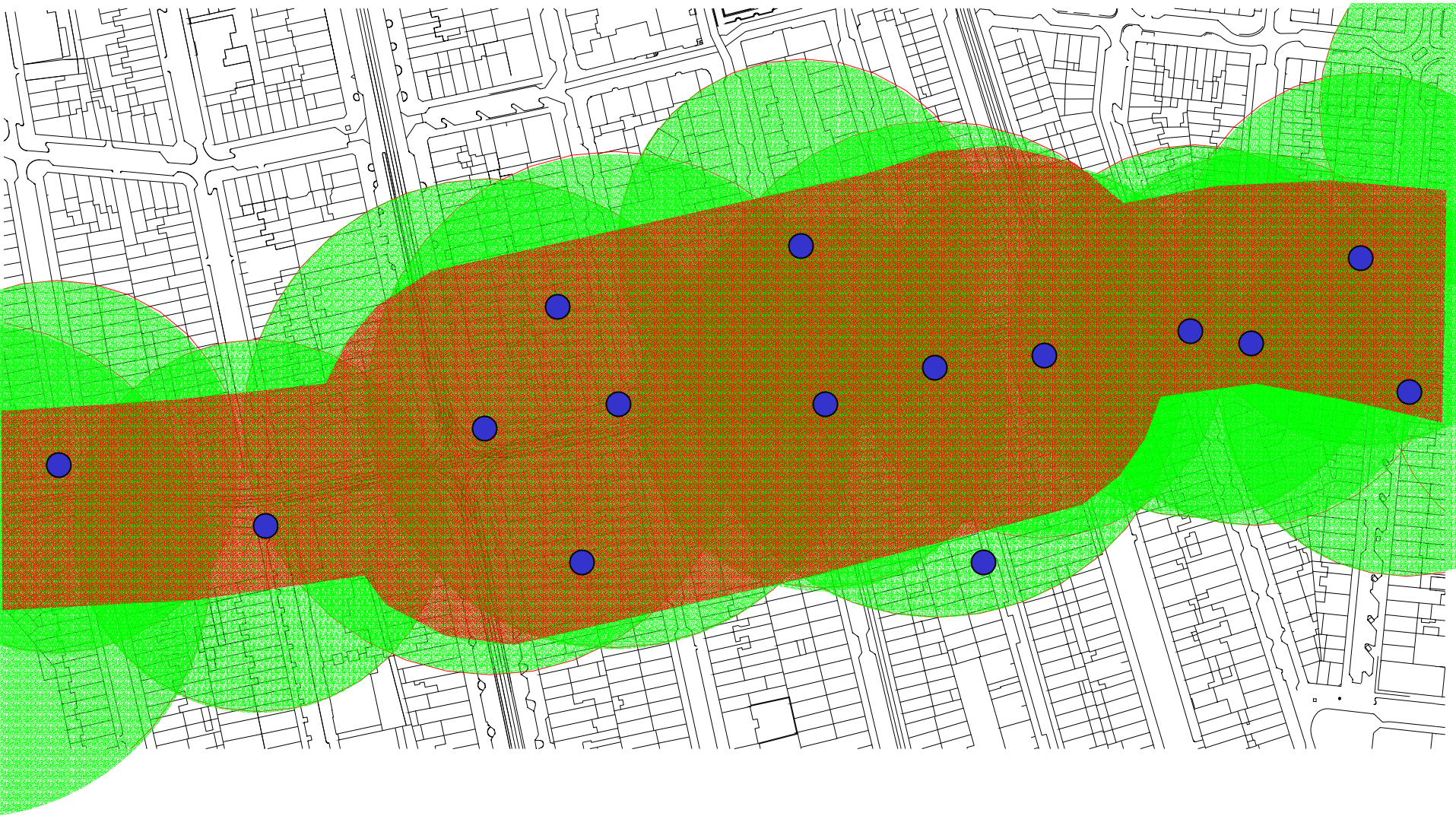
80 Cyclops

6 000 prisms

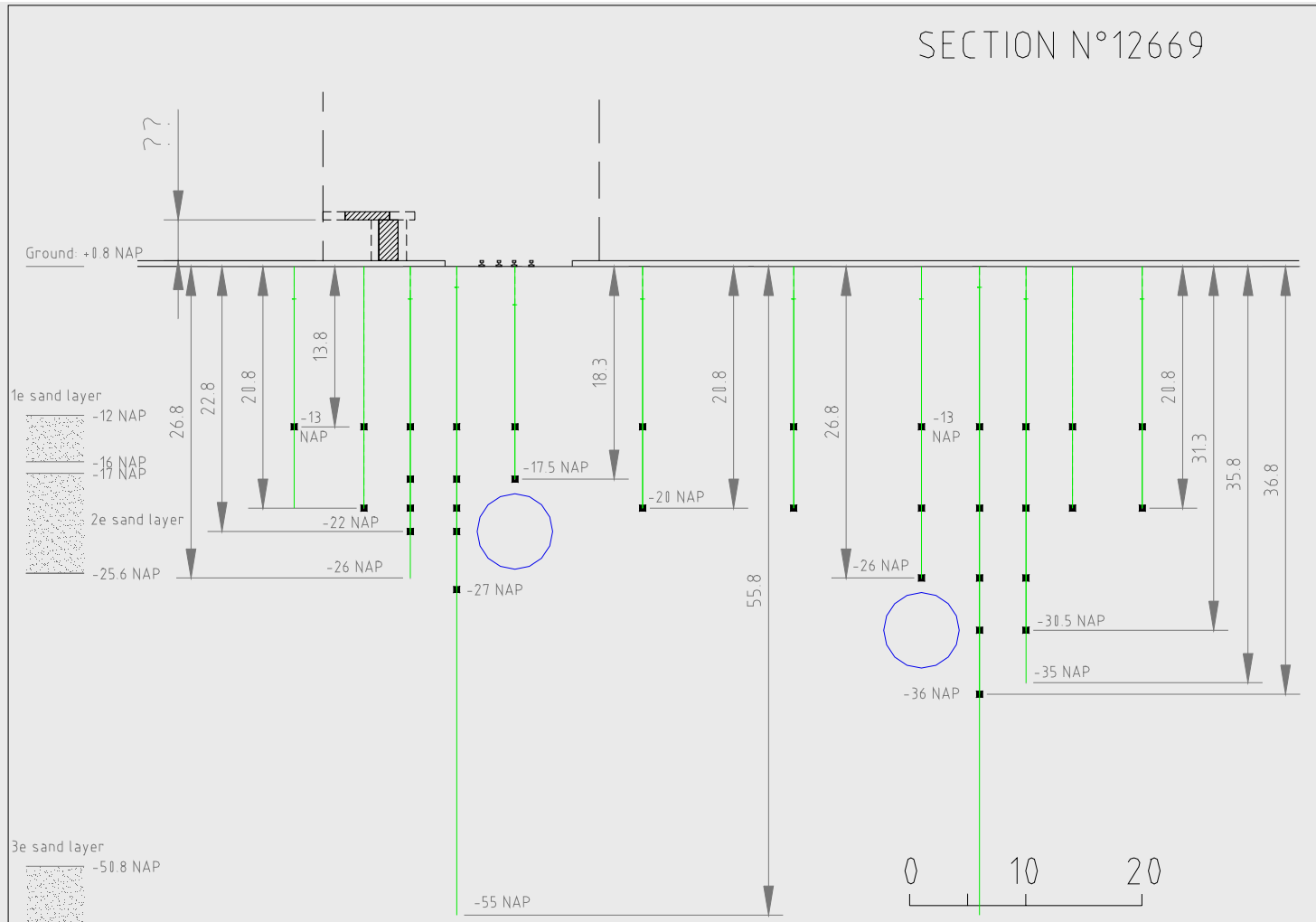


Automatic Surface Instrumentation

Cyclops at Ceintuurbaan station



Automatic Sub-Surface Instrumentation

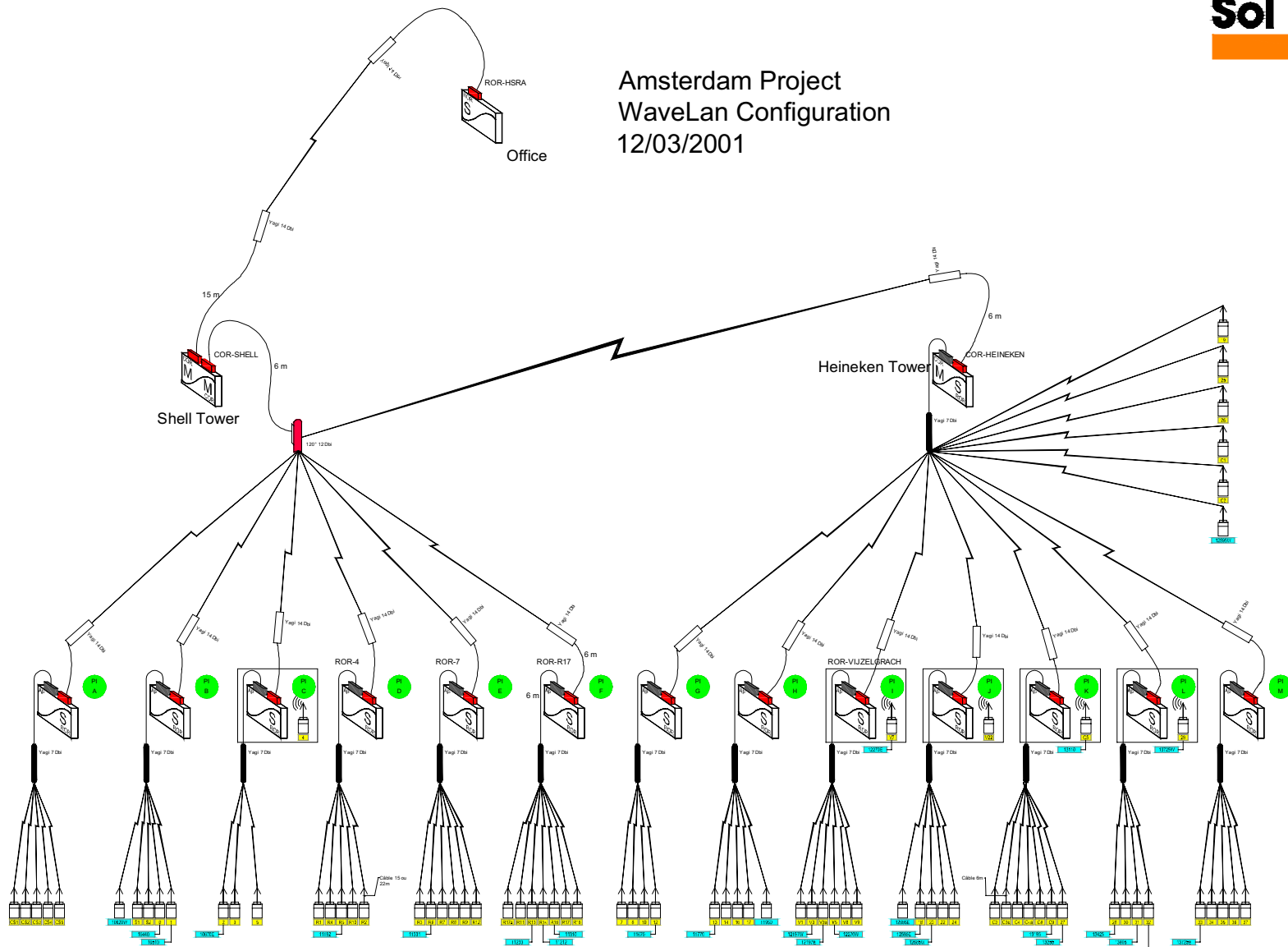


**10 000
automatic
instruments
in
boreholes**

- In-place Inclinator
- Rod Extensometer
- Piezometer

**Typical
Cross Section**

Amsterdam Project
WaveLan Configuration
12/03/2001





Amsterdam

noord/zuidlijn

Amsterdam



Monitoring
area

Central Station

Station Rokin

Station Vijzelgracht

Station Ceinturbaan

Data Processing

- Automatic collection of data (Radio network of 100 computers over 4 km)
- 50 000 Data Per Hour
- Central Computer Room - Real-Time Acquisition and Alarms
- 60 Gigabytes after 6 years

Means

- Installation = 16 permanent engineers and technicians during 2 years
- Monitoring and maintenance = 6 permanent staff during 4 years
- Budget > 10 millions US\$